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SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1934

No. [illegible]

THE UNITED STATES OF AMERICA, INTERSTATE COMMERCE COMMISSION, ET AL., APPELLANTS,

v.

THE BALTIMORE AND OHIO RAILROAD [illegible] CHICAGO, BURLINGTON & QUINCY RAILROAD [illegible] THE CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY COMPANY, ET AL.

[illegible]

817 In United States District Court

No. 4681–E

June 23, 1931

J. C. MURPHY, of Jamestown, N.D., age 66, employed by the Northern Pacific as road foreman of engines, testified in behalf of defendants:

DIRECT EXAMINATION

I was first employed by the Northern Pacific in February 1887 as locomotive fireman. I was promoted to locomotive engineer in 1890, and was made road foreman in 1909. My work as engineer or road foreman has been continuous since 1890.

I heard the testimony yesterday of Mr. G. H. Truman with regard to an accident on May 30, 1921. On that date I came into Jamestown on train no. 2, engine no. 2227. At the time he was injured I was in the cab of locomotive no. 2227 supervising the cleaning of a fire, and so forth. That locomotive was equipped with the Mellin type of reverse gear. I accidentally moved the lever on that date at the time of the accident in reaching over to put the inspirator to work on the right side of the engine. It was a Cellers nonlifting inspirator. The water valve to open the inspirator was down quite low on the cab deck in front of the engineer's seat box. When reaching over to open up the water valve in some way I touched off the reverse lever and moved it ahead. I think it must have been my breast that touched the lever. There was a lot of confusion down there. It was raining and I had on a heavy rain coat and I slipped a little with one of my feet I had up on the deck. It is very possible that my breast came against the latch of the reverse lever, forcing the lever down, but apparently not very far, as near as I can recall now.

I have had experience with both hand reverse and power reverse.

If I had accidentally hit a hand reverse lever in the same way,
818 I do not think there would have been this accident. My reason for that is that there wouldn't be any air power behind it to carry it forward. The engine was standing still at the time. I have never had an accident with the hand reverse. I can not recall having ever seen any accident with the hand reverse. In my experience with power reverse I have had considerable experience with their not functioning properly by creeping. That creeping would affect the valve motion, either shorten up the cut-off, if it crept

backwards, or lengthen the cut-off if it went the other way. We figure it would have an affect upon the consumption of fuel and water. I have known creeping to have effect upon water in a way other than by increasing consumption. It would cause the engine to prime and foam. The water would be carried over into the cylinder. It would affect the valve movement on account of taking the lubrication away.

During my experience with hand-operated levers I have not observed the lever come out of the quadrant and start for the corner. I can't recall, in my experience since 1890, having any trouble with the lever getting out of the quadrant and going to the corner on a hand-operated lever. I have never had a lever get away from me entirely on account of dry valves. I have had them jerk some but I have always managed to get them where I wanted them. I never let go of a hand lever if it got jerking. Different causes cause them to jerk—the valves getting dry, the engine foaming, lack of lubrication.

"Q. Mr. Murphy, when you are speaking about this occurrence, what size engines do you have in mind where you have experienced that?

819 "A. Well, I have run engines all of the way from the smaller type up to that W-3, our heavy-freight power, with the hand reverse apparatus."

Prior to the time I was made road foreman in 1909, I believe that class 2-4's were about the heaviest engines that we had there. The weights on drivers were about 150,000 pounds. I have run still lighter ones, that is, under 100,000 pounds. It has been my experience, as to whether the lever on the 100,000-pound class handles any harder or any easier than on the 150,000-pound class, that after the size of the engines and the classes got heavier they commenced to apply the piston valves and they handled easier with the hand reverse than the old slide valves did with the hand reverse. We had more trouble with valves jerking on the old type of slide valves on the lighter power than we have had with the heavier type with the piston valves. That would be because there was more friction on the slide valves. It would naturally be harder to lubricate the surface. It would take more lubrication to cover them.

When an engine creeps, I have observed that it often comes back by itself, that is, it goes down a little and then comes back of its own accord. You can overcome creeping by dropping the lever down a few notches and giving it a little long cut-off. The kind of repairs we make to overcome creeping are generally air leaks. There are several different kinds of air leaks. Sometimes those air leakages are hard to correct, especially out on the road by the engineman.

"Q. In the shop it is a simple matter to correct that leak when you find it, isn't it?

"A. The engineman generally reports the valve motion creeping and the mechanics may find an air leak and repair it, but there may

be other air leaks that they would not find at the time, and the engine might go out and make another trip or two before they would get all of them taken up."

820 The most effective air leaks we have is the slide valve or the rotary valve. Those are the most effective leaks we have with the power reverse gears. Other leaks would be from the cylinder packing by the piston, leakage at the packing nut where the piston comes out of the end of the cylinder, pipe leakage, supply pipe leakage. Those places are not so easy to check, especially the valve. Outside of the valves the other leakage would not be so hard to locate. In our shop we have one man who takes care of the work on power reverse, that is, where work is done in the day time. And generally the man who is on nights is on the job constantly and he takes care of that. Whoever happens to be on the night job, it comes to him. We have more than these two men who work on the power reverse. There are quite a number of mechanics in our shop (Tes., p. 2981).

Our railroad has speeded up schedules in the last year or two on some of the trains, fast freights and fast passenger trains. Two of our trains are making faster time than they had ever made. Those trains are our modern power, best equipped engines. They have on them the power reverse.

"Q. And you haven't had any particular difficulty in maintaining those schedules, have you?

"A. Well, we have had some engine failures with the power reverse."

We have had two engine failures with the power reverse on our division in the last year, with the precision power reverse. On train no. 1 out of Jamestown on February 27th, I think it was, a valve ring, as nearly as I can figure it, caught one of the valves and vibrated the reach rod so badly that it knocked the drain cock off of the right main air reservoir. That was a valve ring in the steam chest. There was no one injured on that occasion. The effect it had upon the air reverse cylinder was that the air went into

821 emergency on the train and stopped the train. There was no breakage to the air reverse cylinder or to the lever in the cab. There were some of the notches broken out of the latch, three notches, before the vibration knocked off the air pipe.

CROSS-EXAMINATION

We have no engines in my territory that are now equipped with this Mellin gear; it has all been removed. That same accident possibly would not have happened if we had had our modern power reverse with our short lever.

I wasn't with the other occasion. I was in this particular case myself. The other case was October 29th at a place known as "Geneva Sag." The gear got creeping and ran down very suddenly to the bottom of the quadrant and the engineer slowed up the train. There

was no damage done at that point. Those are the only two instances in our territory.

"Q. In the first instance the failure was really in the steam chest or valve mechanism, was it?

"A. As nearly as I can figure it there weren't any links broken but we figured something possibly caught the motion somewhere around there from the way it acted."

It put a violent strain on the reach rod. If that locomotive had been equipped with the hand operated reverse, I don't thing there is a possibility that it would have thrown the lever out of the quadrant. Those reverses are pretty well secured by a heavy latch in the quadrant and I do not believe that it would break anything. Years ago we used to have some trouble with the notches in the quadrant getting worn but in late years the quadrants have all been reinforced with heavier and better material and they have almost entirely overcome that condition. In fact, they have overcome it.

It is a hard thing to say whether, if a man had been handling the lever when that happened, there is a possibility that he might have been injured. The violent strain that I said went on to the reach rod would have no effect upon the lever if a man were handling it when that strain went on. He might feel it. If he had his hand resting on the lever he would feel it. He would feel it if he
822 were hooking up or dropping down the engine when that happened. Whether he would feel it strongly or whether it would be just a mild sensation that he would have would depend somewhat upon the speed of the locomotive at the time. Under the conditions under which this engine was operating when I said there was a violent strain, it could not injure him unless it pulled the reverse lever out of the quadrant; there couldn't be any injury, even if he had hold of the reverse lever. I don't believe it would injure him if he had disengaged the latch and was handling the lever, either trying to hook it up or drop it down. Outside of these occasions, we haven't had any difficulty with the trains in our territory maintaining their schedules.

I have been road foreman since 1909. There are 110 locomotives under my jurisdiction or observation. Of the ones that are in service right at this time there must be 70 percent of them power equipped. There has been an improvement in the functioning of the power reverse since we first began to get power reverse on our road. The creeping now amounts to about the same as formerly. The new apparatus they are putting on has been less complicated. The functioning has been improved by more improved apparatus; that is, they are a better reverse gear. They are better gears than the Mellin. It is a more improved gear. It is not so complicated to handle. We have the Alco gear mostly. That is not as complicated as the Mellin. We have had Alco power reverse gears since about 1926. They were the first we had on our division. There has been no improvement in the functioning of Alco power reverse since the first that we got. There have been no changes at all in them to amount to anything.

They have changed the packing at different times, but the valve gear still keeps creeping. I don't know what was the original type of packing we had. I don't know what kind of packing we have now. I don't think the new type of packing has had the result of making the power reverse creep less than the old type of
823 packing. There has been no change in the rings inside the air piston that I know of.

REDIRECT EXAMINATION

I am of the opinion that the power reverse have not been perfected. That is the big trouble with them. Referring to that occasion when we had trouble with the Franklin Precision where there were tight rings, I think we would have been able to discover that condition sooner with a hand reverse. I have had experience with the Mellin type of power reverse gear first, then the Alco, then the Precision. I have had experience with all of them creeping. I testified that in instances where the gears were creeping a report would be made, and they would be fixed. They would not remain fixed permanently. There is hardly a day on the road in my territory that we do not have somebody call up and tell you such and such an engine is having trouble with the valves creeping. Sometimes it was the same engine that had been repaired.

RECROSS-EXAMINATION

I said that the power reverse was not perfected (Tes., pp. 2981–2993).

I don't know of any further improvements they could make on the manual reverse bar. It evidently is perfected. I say that simply because I don't know of any improvement. I don't know of any improvements they could make. They should be able to improve the power reverse to do away with creeping. That is one of the most objectionable features that we have. I would not say that I know how to do it. I am not a mechanic. I have run a locomotive from 1890 to 1909, about 19 years. Part of the time I had a regularly assigned engine. I operated a number of engines in various classes of service, road, yard, passenger, and freight. I cannot recall any difficulty in that time with a manually operated reverse gear.

(Witness excused.)

824 W. J. TESCH, of Danville, Ill., road foreman of engines for the Chicago & Eastern Illinois Railroad, in behalf of defendants testified:

DIRECT EXAMINATION

I began my railroad experience as a locomotive fireman in 1904. I was promoted to locomotive engineer in 1907. I was promoted to assistant fuel supervisor in 1918. I was promoted to assistant road

foreman of engines on the Illinois division in 1920, to road foreman, Illinois division, 1920 to February 1929 and road foreman of engines, Chicago division, 1929 to the present time. My service has all been with the Chicago & Eastern Illinois. All of my experience as an engineer was on the hand-operated reverse gear. That was the hand-lever type. Since I left the running of the locomotive as an engineer, I have ridden and operated all of the different classes of engines that we have in service at the present time. Up to the last two years I put in about 90 percent of my time riding engines. At the present time it runs about 60 percent of my time. In riding engines I frequently handle them, relieving the engineer. In this way I have become familiar with all of the power on our railroad. I am thoroughly familiar with all of the power. The two divisions I have mentioned include the entire railroad.

The weights on drivers of the engines equipped with hand reverse on our railroad that I have operated range from about 140,000 up to 220,500 pounds. The range of weights on drivers of the engines equipped with the power reverse gears is 189,000 to 290,800 pounds. I have handled engines with the hand lever ranging from 66,000 pounds on drivers to 220,000 pounds on drivers, and I have never experienced any difficulty in handling the lever. I have never been required at any time to over-exert myself in any way physi-
825 cally. My observation, when I have been with other men operating the engines, has been that other engineers have never experienced any more difficulty than I had experienced in my experience as an engineer. They use one hand and sometimes two in handling the lever. It all depends upon how convenient it is. I never have been injured and I never have seen anyone injured on account of the hand-operated reverse lever or in the use of it in any way. I never had the hand lever to become unlatched in the quadrant without being unlatched by the man operating it in my experience. I never have observed the lever getting out of the quadrant. I never have observed any occasion when the lever pulled or got away from myself or the man operating the lever and went to the extreme forward position, or to the back. I have never had or observed the hand lever moving back and forward in the quadrant, being unlatched and moving back and forth by itself.

I am familiar with the Atlantic type of passenger engines in use on our railroad, of which no. 210 is one, no. 210 being the engine upon which Mr. J. L. Stakeman, an engineer on our railroad, testified in this case that he received an injury. I have recently made an inspection of that engine as to just how Engineer Stakeman was injured. We had Engineer Stakeman come to Danville and show us how he was injured. We had Engineer Stakeman place himself in the position in which he was injured. We found that the automatic-brake valve was around on the boiler head different than the brake valve is on other engines of the same class. We moved the brake valve back to the same position that it is on other engines of the same class and it gave us plenty of clearance. I did this possibly

two or three weeks ago. We placed a foot brace on the boiler head so that there would be plenty of clearance in case any other engineer would place himself in the same position that Engineer Stakeman was in when he was injured. When the reverse lever is in
826 the extreme forward position in the quadrant, there is about two and a half inches clearance between the inside side of the reverse lever and this foot brace, which would give you about a two and a half inch clearance on your foot or your leg. The inside side of the lever would be the side that would be next to the leg. The brace we put on there was an inch and a half strap four inches long turned up on the edge so that when you got your foot in there it could not slide over in front of the lever (Tes., pp. 2993–3003).

I have personally operated the class of engines to which this no. 210 belongs in both freight and passenger service. As to the ease or difficulty of handling the reverse lever in operating them, I never experienced any trouble in handling these engines. You can handle them with one hand either standing or running. I have had those engines when the valves got dry. As to the effect of the dry valves, there wasn't any effect upon the reverse lever on this particular engine. I did not notice any change at all in the pull on the lever with dry valves. I never had any difficulty in handling the lever on engines equipped with hand reverse and getting signals. That applies to all classes of engines in service on our road. I have not observed any occasions where other men operating engines on our railroad because of the operation of the hand lever have failed to note a signal, or failed to observe highway crossings. I never observed any engineman having any difficulty in getting a signal.

As to whether there is any difference as to this ability to keep a lookout or take signals as between the engines equipped with the hand reverse and those equipped with the power reverse, when the power reverse gets to creeping naturally your attention will be detracted from looking ahead. You will move the lever and look out at the power reverse cross head to see what is taking place, and you will do what you can to adjust the lever to get the desired cut-off. With the hand lever you never have
827 any change in cut-off that you do with the power reverse because of the power reverse creeping. When you set your hand lever you know that it is set, and it stays there.

We have the Ragonett and Alco power reverse on our railroad, and we have had creeping from the time we first got the power reverse until the present time. I don't know what type of Ragonett it is. It came on the Government engines in 1918. As to the Alco, the first Alco we got was in 1922, and this year we have bought nine new Alco gears that we are applying to engines, replacing Ragonetts. The Alco was the very latest type. Up to the present time there are three of these new power reverse that have been put on. The first one was put on in March 1931, and I think the third one was put on last month. We have creeping on these new gears at high speed.

They had been in service possibly two weeks before we experienced the creeping—as soon as we got them into freight service after we had the engines broken in. As to specific instances of creeping, we have six Pacific-type passenger engines that the company bought in 1923 equipped with Ragonett power reverse. This engine broke the main wheel centers on both sides on all six engines due to the power reverse creeping at high speeds. The wheel centers were all replaced and the power reverse gear changed from Ragonett to Alco and we have not had any broken wheel centers since. In addition to applying the power reverse, we reduced the valve lead to the detriment of the engine. It slowed up the engine. They are not as speedy as they were before.

As to how we arrived at the conclusion that the creeping of the Ragonett gear caused these broken wheel centers, we found that the engine working at 25 percent cut-off or slightly less, which is a very short cut-off, at high speed the power reverse would creep and those engines would go back on center or slightly back of center, and you were getting a terrific pound even in your main wheels that
828 caused them to break. The compression in your cylinders is greatest on center or slightly back of center. High compression is what caused the wheel center to break. The main wheels on both sides on these six engines broke. They did not all go out at the same time. They were at different times. I don't remember which wheel went first. They had so many of them I really couldn't keep track of it. We had that trouble with them over a period of about two years. That was remedied by the application of the Alco gears and reducing the lead in the valve, which would not permit the engineer to work as short a cut-off. We used other appliances in connection with the Alco gear when we put it on. We put friction blocks on our tumbling shaft which reduced the creeping to some extent but it caused the lever to handle harder, that is, the power reverse lever to handle much harder with the friction block on the tumbling shaft. It caused more physical effort on the part of the engineman. I have handled those engines and found that it takes both hands to handle the power reverse lever. I attribute that to the friction blocks on the tumbling shaft. As to the effect those friction blocks have upon the speed of the movement of the air reverse in its operating, it makes it harder to throw and it takes—I don't say more pressure, but it is slower to move. With the same pressure that moves them without it is much harder to move them with the friction blocks on. My experience is that the power reverse lever handles harder than the engines with the hand lever. I am speaking now with respect to these particular engines equipped with the Alco and the friction blocks. All of our power reverse engines are equipped with friction blocks.

As to the tendency of the power reverse on these Pacific engines to creep back to or past center at high speed, and whether I have ever been on an engine when that occurred, I was handling a freight engine equipped with Alco power reverse, possibly five

years ago, handling a 13-car passenger train, and we were
829 running possibly 50 or 55 miles an hour, working the engine at short cut-off, and the valve gear went into the back motion. I thought the engine was on the ground. She danced and there was considerable pounding. I realized what had happened and I immediately threw the lever over to forward motion and this trouble stopped. I don't know that that had any effect on the train. Nothing was said to me by the train crew and I didn't make any inquiry. As to the effect on the locomotive, I just thought she would tear her rods off or break something. That is what I expected. The boiler was jumping up and down and there was noise of different kinds. What I mean is that the whole engine jumped up and down, that is, the part that I could see, bouncing (Tes., pp. 3003–3012).

I still experience creeping with this latest type of Alco gear. Of course, we haven't had the last new ones more than about three months, but we experience creeping. The only difference I can see in my examination of these latest Alcos and the Alcos which we had previously is that instead of the air being piped from the valve chamber into the end of the cylinders these air lines are cast in the cylinder. I have examined the valve and the cylinder. I have not examined the packing.

Based upon my observation and experience as between the hand lever and the power reverse gear, I would say that from the standpoint of efficiency the hand reverse lever is much more efficient and economical. I have not formed any opinion as between the two types of reversing gears from the standpoint of safety of locomotive operation, whether one is safer than the other. In my experience, I have never found anything dangerous or any dangerous conditions with regard to the hand lever.

As to whether there would be any advantage from any standpoint
830 for the Chicago & Eastern Illinois to equip its engines that are now equipped with hand reverse with power reverse gears, the disadvantage for the company to equip engines with power reverse for the reason that power reverse is still in an experimental stage, and any order compelling the railroads to put on power reverse would retard the improvement or perfection of the power reverse. All they would have to do then would be to sell them, and it would not make any difference to them whether they had any defects or not. They would say, "Well, you have to put them on and you have to buy them." I do not think that has been the case with lubricators or with air brakes.

CROSS-EXAMINATION

I said I have handled engines equipped with manual reverse weighing from 66,000 pounds up to around 200,000 pounds on drivers. In my experience they have all handled about the same. I have had no difficulty with either the light or the heavy engine. I said I had no difficulty with this Atlantic type of engine with dry valves. I

had no difficulty with the heavier engines than the Atlantic type when they had dry valves. I didn't experience any pull on the lever on either class when the engines had dry valves. I never have had any other thing about the manual reverse which would cause it to handle harder than usually. I have no criticism whatever of the manual reverse gear. In my experience nothing ever happens to it. As to whether the tops of the notches in the quadrant rounded off from use, I have never had any that has rounded off. The face of the dog that faces forward when the engine is in forward motion has never become worn to any great extent to cause any trouble. I have observed the lever quivering in the quadrant or vibrating when the engine is going along; that is true of any reverse lever from the time the engine comes out of the shop until she goes in. That increases as the parts get older. I have never seen that to the extent that the lever would work out of a notch, or go down a couple of notches further.

I have been running engines since 1907. I have had
831 experience with power reverse since 1918. The engines that my company has purchased in the last six or seven years are equipped with power reverse gears. They have not purchased any that were equipped with manual reverse. They have applied power reverse to engines which were formerly equipped with manual reverse—heavy switchers, eight-wheel switchers. The weights of those are 231,400 pounds on drivers. They have equipped one of those so far. They are equipping those engines with the Ragonetts that were taken off of freight and passenger engines. There have been no engines which were formerly equipped with power and which the company has taken them off and put on manual reverse; it is not possible to get the manual reverse on them. On account of the arrangement of the cab it would cause an off-set in the reverse lever to do that, which would be very unsatisfactory. On some engines they take off manual reverse and put on power reverse. They have not taken that power reverse off and put manual reverse back on.

I couldn't say on just how many different occasions I have observed the new Alco gears creep on these engines which we have equipped since March of this year. It is a general disease and we do not pay much attention to it or make any record of it. Reports are made of it, but I do not have any record of it. I have made reports on it. I couldn't say when I made the last report. I couldn't tell you how many reports I have made since March on these new Alcos. I don't remember whether I made any this month. I don't remember how many times I have ridden engines equipped with one of these new Alco gears this month. I don't think I have made any trips on such an engine this month. I don't remember whether I have or not. I couldn't say positively whether I made any trips in May on an engine equipped with these new Alco gears. I don't recall whether I made any in April. I have no record of whether I

832 made any in March. I ride so many engines that I don't keep any record of it, and I couldn't tell you.

I have no specific cases when the new Alco gear crept on these engines about which we are talking. I know it did creep, because I rode the engines and found it was creeping. I couldn't tell you how many times. As to how the gear acted when it crept, it would creep just the same as it does on all the others. At high speed and working close to center. The speed was 50 miles an hour. I didn't observe whether the crosshead of the piston was working back and forth. I just noticed the difference in the sound at the stack, the difference in the valve motion. I don't recall whether that was when the engine was going down hill. It was at high speed. I don't recall what trip it was when the engine went 50 miles an hour. I do remember the engine went 50 miles an hour, but I do not remember anything else. That is usually when they all creep—at that speed—and I made no particular record of it. I don't know the name of the engineer who was with me on one of these trips when she crept. All of the engineers handle those engines, all that we have, about 150. We have three of those engines that were equipped with these new Alcos. I couldn't tell you the name of any engineer who rode with me on any one of these locomotives. The locomotives run from Danville to Evansville and Danville to Chicago. They are in freight service. As to the trains that they handle, there is no particular assignment (Tes., pp. 3012–3022).

I first observed one of these Alco gears creeping with the new equipment shortly after the engine came out of the back shop, after the engine was thoroughly broken in. As to whether I remember one time when I rode on them, I remember the creeping. I cannot tell you the date nor the engineer nor the engine number. I don't remember whether it was in the latter part of March. The engine came out of the shop sometime in March and I don't remember whether it was in March, April, May, or when it was. I know
833 it was shortly after the engine came out of the shop.

The power reverse broke the wheel centers on these six Pacific engines by creeping back to center. The reverse gear creeping pulled the valve motion back on center or slightly back of center. The compression in the cylinders increased to a point that it threw a strain on the main wheels. It did not knock the crank out. It just broke the skeleton of the wheel.

I couldn't tell you how many Ragonetts my company has in service. I wouldn't say we have a hundred, nor 50. I wouldn't say whether they have had as many as 50 altogether since I have been having experience with power reverse because I don't know. I would say we have as many as 25. We have never had the same kind of trouble on any other engines than these six Pacific engines when they were equipped with Ragonett gear because the other engines are freight engines, and you don't work them with as short a cut-off. They do not get as much strain on the valve mechanism of a freight

locomotive. You do not work them with as short a cut-off so that they creep you have that high compression. We have no passenger engines equipped with Ragonett gears.

As to how it comes that these friction blocks cause the operating lever in the cab to work harder, the friction blocks are clamped down over the tumbling shaft. That holds the tumbling shaft tight. That causes the gear to work slow and work hard. Probably if you would wait long enough to give that time it would not work so hard; but naturally you want to get up there in the reverse position as soon as you can. This operating lever in the cab operates the valve of the power reverse gear. As to how the work that the gear has to do has any connection with the operation of this valve, account of the tumbling shaft being held tight by the friction blocks the air can only escape so fast and the power that is exerted in the opposite end of the cylinder moves that slow so that it can hardly move the lever.

"Q. My difficulty is that I cannot see any connection be-
834 tween the movement of the valve of the air reverse, which is the function of moving the lever in the cab, and the work that the gear would have to do in overcoming the friction of these blocks in the tumbling shaft.

"A. Well, that is what we attribute the cause to—these friction blocks—because before we put them on we did not experience the difficulty of the hard handling of the lever, that is, before we put the friction blocks on."

The operating valve of the power reverse is connected to the lever, and it is connected to the crosshead of the power reverse.

By Mr. McLAUGHLIN:

"Q. There is one question I neglected to ask you about that broken wheel center. Isn't it a fact that all of the pressure comes on the crank pin and not on the wheel center?

"A. But there is a pound into this wheel that caused it to break."

The pound and the pressure comes on the crank pin and on the wheel. The crank pin fits into the wheel. It first comes on to the crank pin; it first comes on to your crosshead and then it is transmitted back. The crank pin is in the wheel center; and the wheel gets as much of a shock as the pin. It did not break where the wheel was pressed on the axle; it broke around the pin fit. It broke some spokes. As to whether it could be that that wheel was pressed too tight on the axle, I wouldn't think that 12 wheels would all be pressed on too tight. It could be. It is possible that the whole 12 wheels would be defective on that account but not probable.

As to the operation of this lever, it is my thought that due to the slowness of the operation of these gears when it has these friction blocks that the engineer tries to speed up the movement by pushing or pulling on the lever. If he did not try to speed it up but let it

take its time, I would not think that he would have to exert any more pull on the lever than he did before we had the friction blocks.
835 I am 46 years of age and I weigh 180.
(Witness excused.)

W. V. RYAN, of Batavia, N.Y., age 38, employed as a locomotive engineer for the New York Central Railroad, in behalf of defendants, testified:

DIRECT EXAMINATION

I have been employed in the engine service of the New York Central since February 1916. I mean that was when I commenced firing. I commenced running an engine January 20, 1920. I have been running about half of the time since that time. The other time I have been set back firing. I have been employed in the Syracuse division. That extends from Buffalo to Syracuse, all in the State of New York.

I have operated engines equipped with power reverse about 75 percent during that time and about 25 percent hand reverse. I have never been injured in any way nor have I observed anyone injured by reason of the operation or use or in any way in connection with the hand lever. I never saw a hand operated reverse gear come unlatched of itself, without the operator unlatching. I never saw a hand operated reverse gear, after being unlatched by the man operating it, get beyond the control of the man. I have never over-exerted myself in any way physically in operating the hand type of reverse gear.

I have suffered injury in the operation of the power reverse. I broke my wrist on the 8th of April 1929 on engine no 5214 at Palmyra, N.Y. I was firing engine no. 5214. Palmyra was a regular stop for train no. 32 to receive mail. The station stop was made and the engineer placed the engine in full forward gear ready to start and received a signal to go, opened the throttle and the engine would not start the train without slack. It was necessary to reverse the engine. We tried to reverse the engine and could not turn it back, tried it three or four times. The operating wheel could
836 be turned about and turned back and to the extreme forward end of the forehead gear. The engineer made a torch to get down on the ground and gave me orders to operate the reverse gear as much as possible, which I did, perhaps turning it seven or eight times both ways, and without any warning the wheel suddenly spun in my hand and the gear went to the extreme back motion, the handle on the operating wheel striking me across the wrist and breaking two bones. That was the Franklin Precision type of power reverse gear. The extent of my disability as to time was 68 days. I was paid $524 by the company. They paid my doctor and hospital bills separately.

As to the length of time required to operate the reversing gear from full forward to full backward motion, or vice versa, on a

Franklin Precision gear compared with the length of time required by the hand gear or hand lever, I would say that you could operate a hand lever about half as quick again as you can a Franklin reverse. I would say you have to make between 16 and 20 turns with the Franklin. I don't know the exact number. I think it takes twice as long to reverse an engine with the Franklin gear as it does with the hand-operated lever. In saying that, I have in mind the ordinary operation of the two types, as we do it ordinarily in going over the road with the two types (Tes., pp. 3023–3033).

As to whether, in case of any emergency making it desirable to reverse the engine quickly, I could speed up that speed of operation with the hand lever and whether I could with the Precision gear, I can recall one example I was called on a road hostling job in 1920 after I first went to running. We took passenger engines from the engine house to the depot for passenger crews. I took an engine from a crew off of no. 7, backed down through the depot on track 7, and at the end of the depot where we went out on the main track there was a three-arm signal. This night I had the lower sig-
837 nal on the yellow, which was a caution signal. I was backing up about 10 or 12 miles an hour and this same signal also took you into a lay-by track, and oftentimes you were held for a period of time. I noticed as I went down by the tower I could see there were three dining cars in on this lay-by track and not room for an engine, and I figured I was going out on the main track. I cannot speed up the operation of this Precision gear faster than I ordinarily operate it. I think I can speed up the operation of the hand reverse gear quicker than the power reverse gear. I continued to back, and the towerman through some mistake had the switches lined for the lay-by track instead of the main, and I was about ten feet from the diners when I discovered where I was going. I immediately applied both brakes and reversed the engine, gave her steam, and just coupled onto the diners without doing any damage. I had a manual control lever on that engine, a so-called Johnson bar type. If I had had a power reverse gear of the Franklin type I would have been unable to reverse the engine in time to do any good to stop and it would probably or it would have caused damage to the diner, like breaking dishes and so forth, which was avoided with the hand lever. That engine was between 200,000 pounds and 250,000 pounds on drivers. It was the Pacific type.

As to how large locomotives we have equipped with the so-called Johnson bar type of reverse gear, I believe they are between 250,000 and 280,000 pounds on drivers. They are the Pacific type, I believe. I am not positive of that. I do not experience any difficulty in handling them with the hand lever. From the standpoint of safety between the hand lever and the power reverse gear, according to my own opinion I would say it is about a 50–50 proposition. I cannot see that one is any safer than the other. I haven't any other situations in mind right now based upon my experience wherein

I would be enabled to avert any accident with the hand lever that I would not be able to do with the power.

838 CROSS-EXAMINATION

On the occasion when I nearly ran into the diners, according to my judgment, I was going about 10 or 12 miles an hour. That was a Pacific type of locomotive. The wheel arrangement as to pony trucks and drivers was three drivers, four engine trucks, and two-wheel trailer. The number was K–3. That Precision wheel that spun around and broke my wrist had a ratchet and latch on it. That was thrown out so I could operate the wheel. You couldn't operate the wheel with the latch in. I do not know what caused the wheel to spin around.

"Q. Did you make any investigation of the parts after the accident?

"A. I went to the hospital."

(Witness excused.)

M. G. LOVE, of Missoula, Mont., age 53, employed by the Northern Pacific as locomotive engineer, on behalf of defendants testified:

DIRECT EXAMINATION

I was first employed in October 1899 in the bridge and building department. I became a fireman May 19, 1901. I was promoted April 23, 1905. I have run continuously as an engineer since 1905. As to the range of weights on drivers of the locomotives which I have handled, I have handled smaller engines than those, that range from 147,000 pounds on drivers to 260,000 pounds on drivers. As to the weight on drivers of those locomotives I have operated that were equipped with hand reverse, the largest one was 207,000 pounds, up to 207,000 pounds. I first operated a power reverse in 1913. It was the Mellin type. Since that time I have operated the power reverse about three-fourths of my time anyway.

I have never had a hand lever jump out of the quadrant of its own accord and go to the corner. As to the clearance in those engines equipped with hand reverse gear, the distance from
839 the seatbox is ample. There is plenty of clearance from the lever in forward motion and lever in backward motion. I usually use two hands in handling a hand reverse. It can be done with one hand.

I have had an unusual experience with the power reverse in May 1930. The number of the engine was 2605. It was a passenger train, with Franklin Precision type of power reverse. This occurred just west of the side track called Gilbert, 34 miles west of Helena. My run in that case was from Helena to Missoula. We were running just west of Gilbert and I noticed a little shake and tremble on the hand reverse wheel. I mean the reverse wheel of the Franklin Precision.

And I was just about to take hold of it, and it gave another shake and threw the latch out and spun to the corner. It broke the brackets off the boiler and tore the reverse gear cylinder off and fell to the ground and bounded to the foot board a few times, and by that time I was getting stopped. I considered that situation had elements of danger. If that reach rod had broken and that cylinder had come back through the cab, I might not have been here. I was running about 55 miles an hour at the time.

CROSS-EXAMINATION

This was the only occasion I had anything break about a power reverse gear. If I had the bolts that hold the quadrant of a manual reverse shear off and the quadrant come adrift, there might be an element of danger to me in the cab if I had a manual lever. I don't know. I have never had that experience. As to the power reverse on this occasion I spoke of, with that long reach rod and this cylinder attached, as it was temporarily dragging on the ties and flying up to the foot board, it might have broken that rod and come back through the cab window. That is what I had in mind. That is what I was thinking about at the time. As to whether about the same thing would happen if the reach rod of the manual lever would break and fly around on the ground, and something might come up and hit me there, I never had that happen. In the one case I think I might have been hit but in the other case I say I never had it happen, so I don't know. That is my answer (tes. 3033–3044).

As to what would be the weight of a light engine that I used to handle, I have handled the Standard engines. I don't remember the weight. They were a little bit of a passenger engine.

"Q. A hundred thousand pounds or under?

"A. What would be the weight of the 760?

"Mr. ALLEN. 60,000 pounds."

The lever handled practically the same on those engines as on the larger manual reverse that I have operated. The Standard engine had slide valves.

"Q. And by larger engines do you refer to those that are equipped with the piston valves at the present time?

"A. Most of the engines we are using are equipped with piston valves now."

There are some times when manual-reversed engines handle harder than at other times, with reference to my ability to handle the lever. As to what causes those differences, dry valves, or the engine being new out of the shop, and cold weather: When I am handling a lever, say, hooking her up or letting her down with the manual reverse lever, and the valves are getting dry, I have experienced a jerking sensation or pulling sensation on the lever to some extent when I was handling it. There is a tendency of the lever to pull away from me. I have never experienced that pull and then let the lever

go. On a few occasions I have observed the lever work out of the quadrant and go down a notch or two while I am running along with dry valves. I guess that was caused by the pull of the valves. Occasionally, at the present time, I get manually reversed engines. As to whether that is when our power-reversed engines go to the shop that we get the relief engine that is manually reversed,
841 you might term it that. Occasionally I get a 2–4 engine, which is a manually reversed engine, on the run I am on now. It is my experience that there is an increasing number of power-reversed engines in my territory.

When this Franklin Precision wheel went around it did not shear off any of the notches of the ratchet or damage the ratchet that was on it. It threw the latch out and tipped over until it was away from it. It spun to the corner. I don't know that the latch was weak. It was there in place and the notches on that particular engine were fairly good in the ratchet. There was a pull of some kind that gave us that little shake and tremble that threw it out. The engine was well lubricated at the time. I did not give the Precision gear any close examination after this spinning took place. It was broken off and disconnected on this occasion between the wheel and the cylinder screw and we had to disconnect the reach rod from the cylinder and the reach rod from the reverse yoke and loaded them into the baggage car. We didn't note anything wrong that caused it. We did not find anything unusual in the valve motion of the engine or in the steam chest. The piston rods and the valve stems were well lubricated when we stopped. As to whether we ran the engine on in, we went on as far as Garrison and had another engine there to take the train in. We changed engines there, and the engine came on to Missoula behind her light. We could have taken the train in. There wasn't anything wrong with the valve gear. We had not had any trouble with lubrication previously on that trip.

REDIRECT EXAMINATION

I said it was the power reverse gear cylinder that was torn off. There is no such part to a hand reverse gear.

(Witness excused.)

R. B. SLOSSON, of Livingston, Mont., age 59 years, weight 157 pounds, employed by the Northern Pacific as locomotive engineer, testified:

842 DIRECT EXAMINATION

I was employed as an engineer by the Northern Pacific in May 1903. I did not work as a fireman before that for the Northern Pacific. I started firing in 1899 on the Indiana, Illinois & Iowa out of Streator, Ill. I have been running engines ever since I hired out

as an engineer with the Northern Pacific with the exception of from 1917 to 1922, when I was road foreman. While I was road foreman I was on engines daily. As to the amount of time I have spent on engines equipped with hand levers as compared with that spent on engines equipped with power reverse gear, it is about half and half. At the present time I am on what they call a through local run between Livingston and Butte, between two mountain ranges. My experience with the Northern Pacific has not all been in that same territory. I have had experience on the entire Montana division. When I first went with the Northern Pacific, the Montana division extended to Missoula; from Livingston to Missoula, by way of Helena and Butte, that is westward and to Billings eastward. That includes all the branches in that territory. I have operated in all kinds of services. I have operated every class of power the Northern Pacific has, with the exception of the last Z-5's, which are simple Mallets.

As to the speed with which we operate on this passenger run which I am on at the present time, 50 miles an hour is what we are allowed with that type of engine, when running, and that is attained wherever possible. We are using 2-8-2, hand-reverse locomotive equipment on that run at the present time. All the engines which I operate on that run are equipped with hand-reverse. The approximate weight on the drivers is 205,000. For two years I had a run where I regularly got a power-reverse gear engine in one direction and a hand-lever engine in the other. That run was between Livingston and Billings. I would have some trips with Precision, and other trips with Alco east, and I would always get the hand-
843 operated engine westward. That was passenger service. We operated at a speed of 60 miles an hour, and we used to fudge on it and get them going more, if we could. The reason for that was making up time.

My first experience with power reverse was with the McCarroll. [illegible] right along the man's feet on the deck of the cab. It is a very dangerous gear. Those were on our Z and Z-1 type Mallets. I cannot thoroughly explain that type of gear. My experience with them was limited. I practically know what they are. There are two cylinders at each end for operating the reverse. Those are the cylinders through which the air pressure was exerted to operate the reverse. We do not have any of those in service now. My next experience was with the Melins [Mellins]. We do not have those in service now either. There are other types in use on our line now except the Alco or Precision, but I have never had occasion to handle them. There are a few Ragonnets on a Z-type switch engine, I believe.

I have had nearly three years' experience in breaking in engines. When I was in freight service, I was always given passenger engines to break in on freight. As to the amount of strength required by me to be exerted in handling the hand lever, my experience has been nothing that was ever injurious to me in any way, shape, or form, whatsoever. When I was breaking in these passenger engines,

I did not have any occasion on which I found it necessary to call someone to my assistance to throw the lever or handle the engine. I would locate the trouble before I left the roundhouse and would not leave the roundhouse with the engine in that condition (Tes., pp. 3044–3055).

As to my experience in the operation of engines equipped with hand levers as compared with engines equipped with Precision type of power reverse as to the degree of tiredness that I would experi-
844 ence at the end of the day's work, I have never felt fatigued with a hand reverse, but with the Precision type reverse, where I was required to do switching at Billings, I have. The reverse is handled in such a manner that I have been required to go to an osteopath for treatment. I could not explain what treatments there have been, due to the reverse power and the strain on the arm.

As to whether I can explain the difference in my movements or method of operation of the hand lever as compared with the Precision, not having any bearing on that question of my being tired or strained in any way, you would have such a short cycle of movement to operate those hard-operating Precision gears, where a hand-operated lever you would have more leverage, not requiring so much strength to be exerted. The diameter of the wheel on the Precision gear is, I would judge, about 12 inches. It would be hard to state what has been by experience as to the amount of effort that I have had to exert in reversing the engine with that type of gear as compared with the effort exerted in using the hand lever, but it has always required more effort to reverse this gear, when it was not functioning the way it should, which was a common occurrence. There are several things which have caused it not to function as it should. In extreme cold weather, a man might use too heavy an oil in the cab, oiling the slide valves; the packing on the operating hand reverse cylinder may be packed too tight.

As to whether the matter of having to have an osteopath treatment after handling a Precision gear after a day's work is a matter of only one occurrence or more than once with me; it practically occurred every time I got two certain engines, nos. 2608 and 2605. I should say at least a half dozen times with the two engines, a total of six times. As to what extent I had any treatment as a re-
845 sult of that, I would go through the osteopathic kind of treatment, and he would go through the motions and I would hear something snap, and my arm would feel all right. I would obtain the desired results on the second or third treatment.

As to the time required to reverse an engine equipped with the Precision type gear as compared with the Johnson bar type, the hand power can be reversed so much more rapidly, especially in the case of emergency, as compared with a Precision. In the ordinary type of operation, both types of gears functioning properly, I can still say the same thing as to the time consumed, you can reverse the hand reverse quicker. I have never received any personal injury

or observed anyone injured by the hand lever or in connection with its use or operation in any way. I have never had the hand lever or Johnson bar type gear become unlatched without anyone taking hold of it to unlatch it. I never had any trouble with the hand lever pulling away from me or getting beyond my control after I unlatch it. I have never observed any such occurrences with other enginemen when I was riding locomotives.

I have had an experience of handling an engine equipped with the hand lever type when I had no air on my locomotive. I was sent out at that time, when I first went with the Northern Pacific in 1903, to deliver an engine at Lombard, Mont. It is the main line of the Milwaukee-Pacific extension now. The Northern Pacific at Livingston maintained power for this road. When I got this engine, she only had one main rod up and no brake whatsoever, and no air. In stripping herself, she would take reservoir pump and everything. I fixed up the tank brake, so that that could be used. That was the common type of brake, as an illustration, the kind used on box cars. A hand brake. There was no pin on it. I robbed an old car and got a pin. I brought the engine to Livingston with one rod up and the hand brake on, brought her down a mountain grade. In going over the summit I had the tank brake fixed, and that line
846 down the mountain at that time we had three sags. If the engine was going over the top of one of the humps at too rapid a speed, I would reverse that engine to retard the speed some, so that it would not get beyond my control and go too rapidly. I had the hand lever type on that engine. In that way I was able to control the speed of my engine as I desired; if I was not, I would not have taken her at the start.

I have had occasions where it became necessary to reverse an engine in an emergency. I know of two instances about three years ago, where it happened on two succeeding trips. The first one I got up to a point where I was going through the cross-over to get to the depot, to get some new train, and I could hear the switch engine working, and looking around I seen he was coming up with a cut of cars, and the line-up was such that he would sideswipe me. I noticed the man on the switch engine was looking backwards, and did not see me, although I had the old main line switch. I immediately reversed the engine and backed out of the way. I was practically going two or three miles an hour when I first noticed this condition. I had just started. I had the hand-operated reversing gear. I did not stop before I reversed the engine, without even applying the air I reversed the engine, without shutting off the throttle. I reversed without shutting off. I did not experience any difficulty in doing that. Assuming that I had had a power reverse gear-equipped engine in that particular circumstance, I would not have been able to reverse the engine quick enough to have saved myself from coming in contact with the other train. He would have sideswiped me.

As to the other instance, the next trip I had received the line-up at the usual point, and a freight train was entering the yard. The switchman who was handling my engines had swung this man down. By "swinging him down" I mean giving him a stop sign. And from my experience, I knew that this man was not going to be
847 able to stop before he got to the point where I was then standing. I reversed the engine and backed out of the way, and he stopped his train approximately ten cars east of where I was standing before I started to back up. I backed eastward when I started to back up. I could not have done the same thing with a power reverse gear on my engine. It would take too long.

I have received an injury in connection with the use of power reverse gears. The approximate date was June 1928. I do not remember the exact date, because I never laid off for the injury. I had the Precision type of gear and engine no. 2608. That engine was a 4–8–4, 260,000 pounds on drivers, I believe. I was descending Townsend Hill at approximately a speed of 60 miles an hour. I know I was going that fast, because this engine had a speed recorder on her, and I timed her and it was very near to that. Some of the notches in connection with the locking device on this wheel had been broken off. I had got approximately one-half to a mile down descending from the top of the hill, and I had the lever locked, when the latch jumped out. I happened to see it at the time, and I immediately put it back. It done it again, and for approximately five miles I set there with my hand around the latch and my thumb around the rim of the wheel. After going a distance of about five miles, I judge, it was too tiresome a position for my hand and too much strain, because the wheel was wabbling, and it was a strained position for my hand. I bent a very heavy piece of wire which would loop over the top of that dog and around the rim of the wheel, each side of the spokes, wherever I desired to lock the wheel. I always carried that in my grip, because we have so much trouble with these wheels jumping out of the locking device. If that does not stay in place on the locking device on the wheel, you might as well not have it on. When that reverse gets to acting up, nothing would hold it. She would knock your dog right out of posi-
848 tion. I took my hand off the lever, and no more than got it off, and the dog went out and the engine went down in the corner, full stroke, the wheel moving to the right. It appears certain that the spokes broke off, or that the rim broke off the spokes and the handle is attached to that, and it struck my knee. As to what was the result of that, I did not lose any time, but I was under a doctor's care for two years taking treatments. Every other day I would go to him for a treatment. The breaking of the wheel did not have any effect whatsoever on my locomotive, because I slowed down, which I had to do, and had to operate that engine by hand with a stub-end, and to lock it I took a combination wrench and fastened on to it, fastened it with a piece of iron, when I was going to make a run of any length without stopping, where I would not

be required to change the cut-off. I was able to get in with the locomotive.

In my experience, I have not found any difficulty or observed any difficulty in maintaining a fixed point of cut-off of the locomotive with a hand operated reverse gear. I have experienced difficulty in that respect with a power reverse gear. At first on long heavy pulls I would notice the engine going lame. That was before I was entirely familiar with the gear, and I thought it was due to lack of lubrication. I would look at my lubricator and see if it was functioning properly. In going through a cut I could hear air hissing outside. The first opportunity when I was not in cuts, I would look at and could see the piston on the reverse cylinder, I should judge, move approximately a half inch back and forth, a total of about an inch the movement was, all told, I should judge. I have heard that condition designated as creeping. I do not know of any better expression for it than that. There are very few trips where you do not get this creeping of power reverse gears. You get those conditions and report them when you get them.

849 Those engines are in a pool, and perhaps you would not receive that engine for a week or ten days, and perhaps you might get her the next trip, and, even so, when you went out of the terminal it would be all right, and when you got outside the terminal it might start creeping, and you might go to the end of the run before it started creeping again. That condition applies both to the Precision and Alco type. I do not know what type of Alco we have. I cannot say that I have noticed any difference in reference to this creeping within the last year or two, as compared with prior time with the Alco and Precision. Just the same. After repairs are made, it would be approximately the same. You are not always getting the same trip after having this difficulty, and it would not be right for me to express myself on that (Tes., pp. 3055–3066).

As to whether I have had any occasions upon which any part of the power reverse mechanism has broken, I have had the latch break or the spring break on the latch on the Alco. On leaving Livingston eastward on no. 4, approximately 10 miles out of the terminal I noticed the reverse lever started to moving toward me, and I immediately caught it, and in catching it I discovered the latch was gone. To hold that lever in proper position from there to the terminal, where repairs were made, when the lever was put at the desired point of cut-off, I put a monkey-wrench around the lever, between the lever and the latch to hold the latch in the corner. That was about in February 1928, I think, if I remember rightly. I have had no other occasions of similar occurrences with the power reverse in getting out of the quadrant.

As to the other instance I mentioned in connection with the spring, that was with the hand operated engine. I discovered that the spring—this was a type of class Q–4, which I think is 150,000 pounds on drivers. The spring was broken on the latch on the reverse lever.

The spring was locked on this lever and the hand reverse being
850 down on the latch on that type, and on the Alco it is up on the latch. Nothing whatsoever took place. But I had to be sure, when I set the engine, to latch it at the desired point of cut-off. When that spring was gone the lever staid where I put it while I was operating my train. I made about 115 miles with it in that condition. It was fast-passenger service. The latch did not become disengaged at any time during that trip after the spring was gone without my raising it with the latch handle. That was engine no. 2193 and the one with the power reverse was no. 2237.

Based upon my experience with the two types of gears, as to the efficiency and economy of locomotive operation of the two types, for myself, from an economy standpoint, I prefer the hand-operated because I can always be assured of the desired point of cut-off and that it will maintain it. As to the two types, from the standpoint of safety, the hand reverse is far more safe. If anything should go wrong, if you are watching the lever at all or noticing what is going on, your hand lever is about the first thing which will tell you something is going wrong. The hand lever is far more safe to hold a train on a mountain grade, when you stop. Under the practice which existed before, we had the E. T. equipment, and we would stop and hold that train by opening the throttle and holding the train by steam for a period of 15 minutes, and if we thought it was necessary, we would require the trainman to secure that train by hand. We do not have that now. We have got away from that now. As to whether under present-day conditions there are occasions we may have to hold the train due to breakage or some other emergency, that occasion is liable to arise at any time. You may strike rocks, which you often do, and which puts your engine brakes out of commission, but you still retain air for your train brake operation. I do not think there are any occasions which arise, or which may arise, where we have occasion to hold our engine or our train back in that manner, without air on either the locomotive or the train line. I have not had any occurrence myself.

851 CROSS-EXAMINATION

As to how many times I have had a rock or any obstruction hit my train and destroy the air, I have never had [it] destroy the air on the engine. I have had it break pipes, but I could remedy the difficulty. That would not put the brakes on the engine out of commission. I have had it occur due to losing the foundation brake rigging. That would just affect the brakes on the engine. I would still have my brakes on the train. As to whether I have ever had the experience of being without air on the train since we have had modern air brakes, I have. That was due to a pump failure, but in answering your question that was not due to striking rocks. That was not with the engine standing. I noticed my pump had failed,

and I immediately stopped the train, and got in communication with the train crew, and I was near the bottom of the grade, and they handled the train down to the bottom of the hill with a hand brake. The pump did not freeze. Due to the fact that something in the throttle valve came off, and steam pressure seized the steam valve. If I had reduced the pressure low enough the brakes would be applied on the train in that case anyhow. If the pumps stopped, it would automatically come to the place where it would do that if the pressure got low enough. If I had that happen, my brakes would leak off in time. It would depend on the condition of the packing in the brake cylinder. I have noticed cars set out on tracks and the brake applied 12 hours afterwards, and air still in the brake cylinder. Take a car with no leakage and perfect packing, and there will be brakes.

I say that the hand lever tells me when something goes wrong. You can tell by feeling of it. There is always a motion which is transmitted to me. You can tell by the feeling of it whether something unusual is transpiring. That motion comes from your valve, of course. Whatever is causing the trouble. It depends on your type of motion. You might get it from your links or eccen-
852 trics, or you might get a bushing seized, and that motion is transmitted back to you. So that whatever goes wrong in the valve motion or in the valves, you feel the effect of it on the hand-operated lever. When we have dry valves, the lever handles harder than ordinary just to a certain extent. You can notice it quicker in the lever. The highest speed at which we have occasion to handle the lever is 60. I have not done that with dry valves. I let the lever alone. Any man is wise to let the lever alone. Several things cause dry valves, and I ease off until it tells you it is all right. You get that with a hydrostatic lubricator quicker than you can with a force speed lubricator. It is safe to do it at 60 miles an hour if you take precautions. I let it alone because it is a manually operated apparatus. I would let it alone because I knew that condition existed and with the power-operated lever I would not know it existed.

"Examiner ROGERS. Why does any wise man leave it alone?

"The WITNESS. If he has had very much experience with any type, he would do the same thing with a power reverse lever, if he had a full warning that the valves were dry, or something wrong with the mechanism, but he does not know that."

As to what happens with the hand lever if you attempt to hook it up with dry valves, it would be harder to handle. I have handled them with dry valves, and while they have been harder to handle, they have never got away from me. As to why I leave the lever alone when getting dry valves and running at high speed, it makes it a little easier to handle to let her lubricate. If it does not quit it, I stop and find out what is the cause. I would not state that it is too hard to handle. I do not know whether it is hard to handle, but I am not going to try it, because I do not know what the trouble is. I have not located the trouble. I did not say I was having dry

valves. I said dry valves or anything else may be the trouble with a seized bushing. There is nothing else which causes me to
853 leave the lever alone besides dry valves and seized bushings. I cannot answer what would be liable to happen if I had a seized bushing and were going at that speed and wanted to handle the lever. That is because I have never handled a lever under those conditions. As to why I would not handle it, I just told you that if I thought there was something I could not remedy I would stop. I have operated engines 800 miles without a lubricator, in bad water districts, during a washout. I would stop to locate the trouble and remedy it if possible. I would not handle the lever because I think I would be very foolish to do so. How would I know what that lever would do? As to what I am afraid of, I do not know. There are lots of things. It depends on the noise going around lots of times which there was on a engine, and you do not know what is underneath that engine. It depends on your motion. You might have an eccentric strap broken or a blade. You do not know what is going on underneath there. As to what that has to do with handling the lever, I [it] is making the lever jump and would have a tendency to pull you to a certain extent. That certainly is what I am afraid of. If I have not located the trouble, I do not know what it is.

By Mr. McLAUGHLIN:

"Q. A broken eccentric blade would create the same condition? Is that what I understand? You would leave it alone?

"A. Yes, sir; I have had an eccentric blade break, around the axle, and catch in the spokes."

You would not always know when that would happen. It depends on the speed you were going at and the noise the engine was making. You would not have to wait for the rattle on the reverse lever to tell you that the blades were broken. You can immediately tell when that condition arises. You understand, I do not know just exactly what is happening under there.

If I had dry valves or seized bearings with power reverse, from my experience with levers, if I knew this condition existed
854 before I touched the lever, I would be afraid to touch the lever, because I would not know what that lever would do, just the same as with a hand operated lever. I certainly would expect the Alco power reverse lever to act the same way I would the manually operated reverse lever to a certain extent. As to what I mean by "to a certain extent", if you want to go into details, it might tear your air cylinder off, and in tearing your air cylinder off, that might be transmitted back to you in the cab with a power-operated lever. As to whether there would be the same power on the manual lever that it takes to pull the air cylinder off, you cannot get away from it; it is bound to be. On a manual gear it is directly connected up with the Johnson bar. But with power reverse you have got the air cylinder in there to take up the force, with the ex-

ception of the Precision. You can reverse the Precision without any power (Tes., pp. 3066–3078).

On the occasions when I operated these Precision gears and later went to the osteopath, I most assuredly was more tired than on any occasion when I was operating a manual lever. I have never been as tired from operating a manual lever as on those occasions. I have got more tired in proportion with that Precision gear in 15 minutes than 12 hours of work with a hand operated engine. That goes for 12 hours also when I am breaking in engines. As to my experience in operating the hand operated lever on the Alco type compared with the manual lever, I have never experienced any tiredness from the Alco. As to whether it takes less strength to handle that than it does the manual lever, I have seen it operate in such manner, for some reason or other—which was reported on and I do not know the cause—where I have had to exert as much strength, practically, to operate an Alco as I have with a hand reverse. Looking at that afterwards, I suppose that was due to my haste and wanting to work that engine more rapidly than I should, than the
855 power reverse would operate. I tried to hurry it. Under ordinary operating conditions when both the hand reverse and the Alco were in workable shape, I never exerted myself with a hand lever nor on the Alco either.

I said that on two occasions I had reversed an engine by hand and averted an accident, or slowed up by using the manual lever as a brake, and that I do not think I could have done that if I had had power reverse. As to how long I figure it would have taken me to reverse the engine with power reverse, I could not tell you, but I should judge, taken on an average, that you can reverse under ordinary circumstances a Precision gear in 18 or 20 seconds, but everything has to be functioning properly for you to do so, and the weather conditions have to be in your favor. Weather conditions, over which the man maintaining those levers has no control, or [are] liable to be such that they will make the levers operate harder. Twenty seconds is not the amount of time I had in mind with reference to these two occasions of averting the collisions; you asked me how long it would take to reverse a Precision power reverse, and I told you, if functioning properly, 18 to 20 seconds. In the second case I had more time, but I was not taking any chances. You see a man descending a 2.2 grade, with 4,000 tons behind him, and you are not going to take any chances, but get out of the way as soon as possible. I cannot say how long it would take to throw over a power reverse, Alco type, but I know you can throw a hand lever quicker, three to five seconds. As to how long it takes to throw over a manual lever, I do not suppose, if occasion would arise and a man has the lever working properly, which he should have—taking care of it and oiling it—that a stop watch could catch it. You would have to get in under a fraction of a second. As to whether that includes the time you would have to get to the lever,

you are right there at the lever at all times, when you are sitting on your seat. I do not give her quite a yank to get her over in a case like that; when I make a trip on an engine, a small boy
856 can handle the lever. In the ordinary operation I just take my time and pull her over easy. When you are going to have a side-swipe your movement is quicker. As to how I operate it when I think I am going to have a side-swipe, I simply put my foot on the board like that and pull her over [indicating]. I have got a perfectly counterbalanced spring, and the engine operates in one way as easily as in the other. Of course, when you start to throw it over that way, and there is some slight obstruction down in the valve gear that caused a little resistance when you pulled it over, you would have to exert a little more strength, but after she once started she should go over as easily as before. As to whether I could feel that slight obstruction down there, if it was too bad, of course, it would stop me. If it did not stop me, I think I could throw it over all right with a hand lever. I possibly would have to apply a little more strength.

It was in June 1928 when I had this experience I related in going down Townsend Hill. I do not remember the day in the month, because I made no report of it. If the work reports were traced up, you could find a new wheel was applied to that engine at Livingston. As to whether I was under the doctor's care for exactly two years to the day, I cannot swear to the day. I said it was practically two years.

As to when it was that I observed the power reverse hissing when the engine went lame, it was when we first had the Alco type gear applied to our type of power, class Q–5 engine. I think that was around the first chance I had to operate one of those. Under that condition I think it was in 1926, if I remember rightly. They had the Meline gear on previous to that, and they took that off. I still hear that hissing noise occasionally. It comes from your exhaust ports on your air cylinder. I do not always report it when I find that condition of hissing because I do not take the engine to the house. The engine goes through, and I make a notation or
857 give the man that relieves me, who takes the engine through, a report on it.

I said there are very few trips that I do not get creeping and that I report it. If I do not report it direct, I report it to the man who relieves me, and he reports it, and either reports it or passes the word along until the engine gets to the terminal, where it ties up. I have not reported a creeping power-reverse gear in the last month because in the last month I have not had an engine of that type. The last time I had a power-reversed engine was about the first of May of this year. I was on that run, I think, very nearly two years, and I would have power reverse eastward and hand-operated westward. As to how many times I reported an engine for creeping with a power reverse over the space of a month, there would hardly be

a trip. That would be 15 times I would have a power reverse eastward. I doubled the road every other day. It is hard to state how many times out of those 15 one-way trips I reported the power reverse in one month. I know they were numerous. I did not take the engine to the roundhouse, because it would go on through, but I would call it to the man's attention who relieved me. I have filed a work report myself on power reverse; when they cut the power off at Billings, I filed work reports. I could not state the exact date. I remember that I have done things of that kind. It was not five years ago. I do not remember in the month of May of this year of having to have the power cut off at Billings. It might be such a thing that I did, but I do not remember the occasion. As to whether I can remember any occasions when I filed a work report at Billings in the last year, I cannot remember the date or the month. I know the occasion has arisen, but this is something which has happened to me: I won't get that engine again, possibly, for quite a while, and if I should get her the next trip, I happen to remember that and would note the work had been done. I cannot give you any estimate of the number of times I have reported power
858 reverse at Billings in the last year because it is impossible to tell how many times the engines have been cut off at Billings. Before they run into Jamestown, the engines ran through the Glendive. I do remember some cases, but I cannot tell you the specific dates or the engine numbers (tes., pp. 3078–3087).

I spoke about the spring coming out of the manual lever on one occasion. That spring is there to hold the latch in place, to hold the dog, if you want to call it that. Some call it the dog and others the latch. It did not make any difference to have the spring come out. The engine had perfect teeth on the quadrant and perfect teeth on the latch.

"Q. That was exceptional luck, was it not, that it did not come out?

"A. Since the adoption of the piston valve, I cannot tell you any. I have on occasions noticed conditions of the reverse levers, because we on our engines have what we call an air blower for blowing out dust in the cabs, and I blow out any dust that might get in the teeth of the quadrant, and the lever was always in the back motion when I have done that, and I have occasionally noticed the condition of the teeth on the latch and also on the quadrant, and since the adoption of the piston valve, I do not know of an engine that I could cite where I have noticed that the teeth on the quadrant or on the latch have been worn."

As to whether you might as well take off the spring which is used to hold the dog in place, so far as my part is concerned if they all operated like that one. That is my only experience in that way. You cannot get me to concede that the spring is not necessary at the present time; the spring is an additional safety device, the same as on your latch, of the power-operated gear.

As to whether I would say I had more difficulty with the lever moving in the quadrant with the old slide-valve engine, I had
859 more difficulty in handling the lever; not more difficulty handling it in the quadrant, but in moving the lever, and I had more difficulty, due to the increased surface on which the valve bore. My judgment would be that the engines having the small slide valves were harder to handle the reversing gear than the larger engines which now have piston valves. I have seen occasions where the small slide-valve engines would handle far harder, but while you are on that subject, I can go on and add more to it. Take when they first applied the piston valve, and we have it on the larger type engines. On those your reversing mechanism is bound to handle harder, because you have more weight, but it does not handle as hard as you would think, due to the fact that the counterbalance spring is put in there to take care of that increased weight. The counterbalance spring is heavier for your heavier power than for your lighter power. I never operated a slide-valve engine weighing 100,000 pounds. Approximately, I would judge, the last slide-valve engine I operated was—it has been so long I would not give the weight. I know they would weigh under 80,000 pounds. I will say they were harder to handle than the piston-valve fellows.

REDIRECT EXAMINATION

I have never had had an occasion where it was necessary to move a lever with dry valves, going at 60 miles an hour. I have never had occasion to handle or move the hand lever when I have experienced any danger to myself in so doing. As to whether you can hold a train on those mountain grades on my division when you have no air brakes in operation on your engine and have to depend alone on your train brakes, you can after they have once stopped the train, that is, the train has once stopped. You can hold the train with the air brakes on the engine not working and the train brakes working, but it is not the safest thing to do, due to the fact that your brakes might leak off, if the train is not secured by hand. The engine brakes are handled by straight air on E. T. equipment.
860 I was talking about standing and holding the train. You can possibly hold a train standing and release your engine brakes for a length of time, but it is not a safe operation to hold your train with your automatic brakes on your train for a length of time, especially a freight train. I was talking about the train standing, holding it with the automatic brakes applied on the train, when standing. I have never used the reverse lever to hold the train, not any more with the E. T. brakes, or the straight air, after you have once stopped. If I am descending a mountain grade and should lose my air, I would not hesitate to reverse the engine by hand to control it. The hand lever on the power I am now using would enable me to do that with a hand reverse.

RECROSS-EXAMINATION

The type of engines I am referring to now is any type with a hand lever, if I was descending a mountain grade with a hand lever, with a light engine. I am not referring to the engines that have power reverse at all, just the hand-lever engine. The kind of engine with the hand lever which we are now using on those mountain grades is class W, 2-8-2, 205,000 pounds on drivers. With the power reverse I could not reverse the engine under the same conditions of having lost my air. You have got no air to reverse them with. The steam connections have been taken off all our air reverses.

As to what is the highest speed that I have ever reversed an engine at, when it is running along, I do not know, practically, outside of that experience in descending the mountain grade, that I have ever reversed an engine over 30 miles an hour. I have put the engine in back motion with a manual lever going 30 miles an hour. Nothing happened to the running gear or any parts of the locomotive; nothing much could happen. It only had one main rod. The wheels kept on going in the direction in which the engine was going; the wheels revolved in the direction the engine was
861 going, and compression and steam were retarding the engine in the direction in which the engine was going.

DIRECT EXAMINATION

As to whether on this occasion I eased down on the throttle before I reversed it, in some cases I would steam in reversing and other times compression. If I thought there was not enough compression to obtain the desired results, I would assist with steam. I would be drifting then.

RECROSS-EXAMINATION

The sole basis of my opinion that the manual bar is safer than the power reverse is the fact that I have been injured with power reverse, and I never was injured with manual reverse.

(Witness excused.)

EDWIN C. COYLE, of Missoula, Mont., age 47, weight 145, employed in the engine service of the Northern Pacific Railroad, testified:

DIRECT EXAMINATION

I have been in the engine service of the Northern Pacific since November 1904. I was employed as fireman from November 16, 1904, until July 8, 1908. Since that time I have been running as engineer, with the exception of two months in 1914, when I was set back firing on account of reduction of force. The territory in which I have been running is with headquarters at Missoula and running east to Helena and Butte, west to Paradise and Wallace, Idaho. That is called the Rocky Mountain division.

I think it was about 1909 or 1910 that I first had experience with power-reverse gears. That was the McCarroll type. I think it was about 1913 that I had experience with other types. That was the Meline reverse gear. I had experience with those for several years following that. They have all been taken off in my territory.

862 I have had some experience with the Alco since that time, beginning, I think, about 1926. I have had very little experience with the precision-type gear, two or three trips is all. Since 1914, I have used the hand lever up until the last four or five years, when I have used the power reverse probably 90 percent of the time. The remaining 10 percent was hand levers. I have occasion to operate engines equipped with hand levers from time to time at present. The largest engines I have operated with hand levers, as to weight on the drivers, are about 207,000 pounds on drivers. That was the 2–8–2 type of engine (tes., pp. 3087–3099).

As to what has been my experience as to the amount of strength I am required to exert in a physical way in handling the hand-lever type of reverse gears, it has never bothered me to any extent. I have never found any occasions in operating the hand levers when I could not handle them myself and had to call anyone to my assistance. I have never had the hand levers become unlatched without my unlatching them myself. I have never had them pull away or get beyond my control in any way, after I unlatched them. I have never experienced any difficulty in maintaining a fixed point of cut-off with my locomotive equipped with a hand lever.

I have frequently experienced difficulty with maintaining a fixed point of cut-off in running with the Meline power reverse and the Alco. I have never had any experience of gears creeping when the engine was standing still. The way I have noticed the failure to maintain a fixed point of cut-off when my locomotive has been in operation with a power-reverse gear is the gear creeping. When I had the valve set at the desired cut-off, the reversing gear, the power-reverse gear, would creep forward and give me a larger or longer cut-off. I have observed the action of the valve motion or link motion when the gears were creeping. I have observed a kind of a

863 jumping motion, the link block jumping in the link. It appeared to be jumping two or three inches anyway, sometimes, and on one occasion I had to shut the engine off on account of it jumping probably the full length of the link. I have made a particular observation of that condition. I went out on the running-board and looked at it while the train was in motion. I have observed it several times from the cab, without going on the running-board. As to whether, the time I had to shut off, I made an effort to control the jumping of the link block before I shut off, I tried to adjust it by the operating lever of the reverse gear, but it would not stay there. On other occasions I have been able to overcome the jumping or creeping for a short time at low speed by moving the operating lever. That is, it would stay there a few minutes and then creep forward again, and I would have to adjust the operating lever

again, adjust the gear, and then it would stay there for a few minutes and creep forward again. I have in mind the Alco type of gear to which that jumping and creeping refers.

I have never received any injury or seen anyone injured with a hand type of reverse gear. I have been injured with a power type of reverse gear. I was on the rear of the train, helping, and I went to or I unlatched the reverse lever of the Meline gear, the long lever, and it jumped from the forward motion to the back and caught my arm against the backboard of the cab and threw my left thumb out of joint. I did not lose any time. The engine was moving. I think that was about 1914 or 1915. I do not remember exactly.

I lost the air on my locomotive on one occasion with the old McCarroll power reverse gear. I was running a light engine down Helena Mountain, and had a meet at Austin, and the pipe leading from the pump to the main reservoir broke off, and I lost all the air on the engine, and could not set the brakes or reverse the engine. This McCarroll gear has a crank with which you can reverse it by hand. I could not find the crank. It was on the tank covered
864 up with coal, I found out afterward, so that I had nothing but a 12-inch monkey wrench to turn that with. This happened about two miles from our meeting point. I went right to work with that 12-inch monkey wrench, but did not get the engine stopped in time to head in where I should have headed in. I ran about 30 or 35 car lengths by the switch. This train was a little late on meet, and when I got the engine stopped, it was about 7 feet from the engine of the train I was supposed to meet. I was on a descending grade all the way from where I lost my air to this point. If I had had a hand lever on that engine, it would have made a difference as to my ability to control the engine on the descending grade. I could have reversed the engine and admitted steam to the cylinders and have stopped.

I saw a fireman injured at Saltese, Mont., in January 1927 with the McCarroll type of gear. The operating lever which controls the air motor on this reverse gear broke inside the air chamber, and I had to reverse the engine by hand. It worked pretty hard, so that the fireman came over to help me screw it over. In doing so, his hand struck the cut-out cock which cuts the air out from the motor, and the motor immediately started to reverse from the air pressure. The crank, turning very fast, struck him on the back of the hand and broke two bones in his hand.

From the standpoint of economy and efficiency of operating a locomotive as between a hand lever and the power reverse type gears, I should think the hand lever would be the better. From the standpoint of safety as between the two types, I would say the hand lever, too.

CROSS-EXAMINATION

I am not a member of either of the engine-service brotherhoods. We have not had an increasing number of power-reversed engines in

my territory in the last five years. I do not think there are fewer manually operated engines in my territory now than there were
865 five years ago. I think there is about the same number. As to whether the condition of our power has remained about the same, I think we have the same engines there that we got five years ago, with the air reverse and the hand lever operated engines. As to whether we have gotten any new engines in my territory, we have got the A engines, the passenger engines. They have power reverse. We have no new engines which have been equipped with manual reverse.

I said that the hand lever never bothered me to any extent. As to what I mean by any extent, I never have to exert all my strength in order to handle one of them. As to what weight engines I have in mind when I say that, the W engines are the largest. They weigh about 207,000 pounds on drivers. I have run with them since about 1912, I guess. I have run switch engines equipped with slide valves, weighing under 100,000 pounds. I have never observed any particular difference in the handling of the lever on those small engines as compared with this 200,000-pound fellow. The 200,000-pound class has piston valves. As to whether, with both of those types of engines, the small one and the large one, I have observed any difference in the handling of the lever at one time over another, I cannot say that I have. I have handled them when they have dry valves. The lever will handle harder with dry valves than when they are well lubricated. I have had tight bearings in the link block. That makes a difference in the handling. The counterbalance spring does get out of adjustment. I do not believe I ever had a weak latch spring. I do not remember having one that is too strong, making it hard to handle. I have never observed any play in the quadrant where the dog fits into the notches, when the engine is running along. I have never noticed having a quadrant where the notches were worn, the top of them tapered out, where the dog fits in. I have never observed that the dog would wear any. If the valves get dry the manual lever will vibrate in the quadrant
866 when you are running along at a pretty good speed. I have never seen that lever work up so that the dog works up, with a tendency to work out of the quadrant. Whether the valves are dry or not, with me the lever has remained in the quadrant firmly seated. I have never seen it do otherwise (Tes., pp. 3099–3108).

I have had passenger service with these hand-operated levers. The highest speed I make is 60 miles an hour. I have never handled the lever going at 60 miles an hour. Probably 40 or 45 miles an hour would be the highest speed at which I handle the lever. I have handled the lever at 45 miles an hour, when I get dry valves. If the valves were dry, I would close the throttle almost off, and then handle the lever. As to why I do that, I figure that is the proper way to do it.

"Q. Why was it proper?

"A. It would not be a case of being afraid of the lever, or anything like that, but it would be just using your head, I should think, to give the engine a chance to oil itself."

As to what position I would put myself in when I go to handle it at that speed, I would take hold of it with both hands. I would not brace my feet against the boiler. I might put one foot forward with a brace on the floorboard. I do not have a foot brace at the front of the quadrant on those engines, or anywhere near it. I never brace myself against anything when hooking up the engine or dropping it down; I never do, except simply putting my weight on the floorboard. I put one foot forward enough for a little brace, as one naturally would pulling on anything. You have to exert some strength in handling the lever under those circumstances, certainly; you would have to pull it up or move it.

On these occasions where the Alco creeped many times, the valve would go down and come back of its own accord. I said that happened two or three times and I would correct it by adjusting the lever. I have never had any injury to myself from an Alco power reverse creeping. I have never broken any parts about the
867 engine or the reverse gear. As to about what, in my judgment, would be the percentage of trips where I have a lever creeping to the extent that I could not overcome it by adjusting the lever or allowing it to come back itself, you can overcome it for a little while by adjusting the lever, but it would not stay that way. Probably in a few minutes it would creep again, and you would have to adjust it again. That is a momentary operation to adjust it, just takes a movement of the lever. As to whether I have ever had any occasion when I was not able to overcome it by adjusting it or allowing it to come back itself, I have had one trip that after I got up over a speed of about 25 miles an hour, the gear would creep, and I could not adjust it. It would not stay there. I would pull it back and it would go right back down again. I did not observe what the difficulty was with it at that time; there was no visible effect that I could see. I reported it when I got into Helena. I do not know whether it was taken care of. I did not have the engine again.

"Q. That is the only time that you can remember when you were not able to adjust the lever so as to overcome creeping?

"No. It would not at any time. I have never seen one that would stay adjusted and overcome the creeping, because the creeping would repeat, shortly afterward."

You can correct that condition, possibly for a couple of minutes, even when it does repeat, by moving the lever as soon as it starts to creep again, and then it will creep again. I should think there was something dangerous about this Meline lever when it went from forward to back motion. As to why, all they got was my thumb. If it pulled me back, it might have broken my arm and probably would have broken my arm, if there had not been a slot cut in the backboard that my arm went through. If I had gotten in the way of

that lever with any part of my body, the result might have been serious. It probably would have hurt me anyway. I hardly think that would be the case with any lever of the size of the
868 Meline lever. I do not think that the lever is responsible for that. I think it is the mechanism which is attached to the lever. As to whether, in the event that some part of the valve motion would get out of alignment and throw a strain on the reach rod, I think the manual lever would have a tendency to do the same thing the Meline lever did, I never saw it happen; never heard of it happening. I think it is possible it could happen. I do not think there is sufficient pull that could be put on the manual lever to cause it to go back and forth from the action of the valve motion. It is directly connected up with the valve motion, that is, running at high speed, when the engine is going along, but I do not know anything that would throw it back. I do not know anything that would throw it forward. If it became unlatched, it might go forward. If it became unlatched, it would go forward. The natural motion of the links is in the forward motion, and it would pull it down if it came unlatched. If you were in front of it, I imagine that would be dangerous, but there is no need of being in front of it.

On a manually reversed engine, I keep my feet by the seat box. I always have them right there in front of me. I might change my position around slightly and move my feet to different parts of the floor. As to whether I ever got them anywhere near the quadrant, sometimes in switching my position I would turn around sideways on the seat box. My feet won't strike over on the quadrant. I always keep them off of it.

As to why I think that the manual reverse is safer than the power reverse, in the case of loss of air with the power reverse, you would not have any way to reverse your engine, and with the manual reverse, if anything happened to your air, you could reverse your engine and stop it. That is what I based my opinion on. You can, as I said, stop by reversing the engine and then, another thing about the manual lever is
869 you are not so liable to be injured with it because I have never seen one fly from the back motion to the forward motion, or from the forward motion to the back motion. I have never seen an Alco power reverse, the hand operated lever in the cab fly from forward motion to back motion, without my moving it.

"Q. Then you have had no experience with a power lever doing that except this old Meline type and the McCarroll?

"A. Yes, sir; the Meline type and the McCarroll. I have never had the McCarroll fly from one position to another, because they won't do it."

As to whether I ever observed any difference in the economy of operating an engine where the power reverse did not creep and the hand reversed engines, I know they will burn more coal. I have noticed that. I have in mind our W-3 engine which burns more coal, which is power reverse equipped. The weight is about 250,000 pounds on the drivers, I think. We do not have a man-

ually operated engine of the same weight. I am not comparing engines of different sizes when I say that; sometimes you take the same class of engine, where the gear does not creep, and then take it again where it does creep, and you can notice a difference. When the gear does not creep, there is no difference in the efficiency of the engine.

(Witness excused.)

GEORGE W. JOHNSON, age 56, weight about 170, employed by the Northern Pacific, testified:

DIRECT EXAMINATION

I have been employed by the Northern Pacific since 1895. I served as a fireman about 6 years. Since about 1901 I have been running as an engineer practically all the time except when I was laying off. I have been running in the St. Paul division mostly.

870 The first year I was sent up I did work between Staples, Minn., and Fargo, N.D. I have had experience in general between St. Paul and Fargo. I have had but very little experience with power reverse gears. I guess between 1919 and 1920 occasionally. I had experience with the Alco and Precision or the Franklin type of gears. I do not think the time I have operated the power reverse would amount to over a year. With that exception I have used the hand lever type of reversing gear. I am using it at the present time. I am working in passenger service between St. Paul and Staples. It is a local run at the present time, a fast one, though. The scheduled time and the distance which I run with that passenger train is four hours and twenty minutes; 42.2 miles. On an average, I have about 15 to 17 stops in that distance. The type of engine is 4–6–2 and weighs 150,000 pounds on the drivers (tes., pp. 3108–3119).

The heaviest engine that I have used with a hand lever is class W engine, 205,000 pounds, and the lightest between 70,000 and 80,000. I have not used any strength out of the ordinary in my experience in handling the levers. I have not exerted myself. I have never had any occasions when I had to call anyone to my assistance to enable me to handle the lever. I have never been injured or observed anyone injured by a hand lever or in connection with its operation in any way. I have never had the experience of a hand lever pulling away from me or getting beyond my control after I unlatched it. I have never had any occasion where the lever unlatched itself and moved in the quadrant down to the front corner or to the back corner.

As to what has been my experience as to the length of time required to reverse an engine equipped with the Precision type of power gear, as compared with the hand lever, with an Alco, I think it would take about twice as long. I think with the Precision about three times as long. I am speaking of the ordinary operation of

both types. In an emergency, as to the ability to speed up the
871 operation with the hand lever and the two types of power-reverse gears, with a hand lever you can operate right away, and with the power reverse you have got to let it take its course. It only works so fast, except the Precision. You can screw that faster, but it takes quite a bit longer. You have to make from ten to twelve revolutions of the wheel completely to work the valve motion forward to backward, or from backward to forward.

I have had no trouble with hand-lever equipment as to my ability to maintain a fixed point of cut-off with a locomotive. As to what has been my experience with the power-reverse gears during the time I have operated them, I never had any experience only once, and that was on a transfer run, going uphill, and the engine started to work lighter. I did not know what the trouble was, and I dropped the hand lever down and latched it there. I put the lever ahead some in forward motion, and let her work at a longer stroke, and I had no more trouble after that. That was my only experience. It was only a short run, a few miles. As to whether I ever had a power-reverse gear on a freight run other than transfer service, I was never on a freight run other than transfer.

I have never at any time experienced any danger to myself in the actual operation of the hand lever. From my experience, I could not state any way in which the locomotives which I have operated, equipped with hand levers, would be made any more safe to operate if they were equipped with power-reverse gears.

"Q. What is your opinion, based on your experience, as to the speed of operation of the hand lever and the power-reverse gear, as to whether or not there is any difference between them from the safety standpoint?

"A. Yes, sir."

As to what I have in mind in that respect; I have in mind that if the occasion occurred where I would have to reverse the engine quickly, I would not be able to do with the power reverse as quickly as I would with a hand reverse.

872 CROSS-EXAMINATION

It takes possibly two or three seconds to reverse an engine with an Alco reverse gear. As to how long with a manual bar, pull it right over [indicating]. One or two seconds.

I never did operate a Mallet. The largest engine I have operated is 205,000 pounds on the drivers, wheel arrangement 2–8–2. I never operated a power reverse of that type. I have never operated larger engines than that which were equipped with power reverse. I have handled this 205,000-pound engine in local service on transfer. I never kept track of the trips I have made with that big an engine. I run where we did not have that type engine, and would get it occasionally. It might possibly be ten trips a year when I would catch it. The size of the engine that I usually have on this local passenger run is 150,000. We make up as high as 60 miles an hour

with that. Once in a while I have to take slack at the stations when I am starting out. I do not handle the engine with steam in the cylinders when I am taking slack; I open the cylinder cocks.

"Q. Are you always able to open the cylinder cocks when the engine is standing at a station?

"A. We are not right in front of the depot when we stop."

I have occasions when I cannot open the cylinder cocks because of people who are working around the engine. I do not keep track of whether I reversed the engine under those circumstances. I may have at some time or other. As to whether I ever noticed any difference in reversing the engine with steam in the cylinder and when it does it [not] have steam, it will reverse a little harder. As to whether I am able to reverse it with one hand with steam in the cylinders, as a rule I use two hands at all times. I do that because it is easier for me, and is a habit. I have been on local freight runs but not an awful lot. The majority of my experience, as to kind of run, has been through freights and passenger work. I handle
873 the lever with both hands when I am hooking her up, giving 30 or 35 miles an hour. Possibly I brace my feet against the boiler once in a while. We do not have a foot brace on those engines. I do not always put my foot against something. On the occasions when I do, I do not know the reason for it. Maybe to make it easier. If you are going to pull, it would be true that you could keep your balance better. As to whether I would not handle the lever without bracing myself if the valves were getting dry, going at 35 miles an hour, I would ease off on the throttle until the engine lubricates. As to whether I notice any difference in cold weather in the handling of the manual reverse, if it is frozen up with snow it will operate harder. I have never exerted myself to cause any injury to myself in throwing over the engine when the links are frozen up in the wintertime. I have never ruptured or injured myself by that. A manual reverse would handle harder in the wintertime when the links are frozen up than one of these Alco power reverses. When there is steam in the cylinders, a manual lever handles harder than a power reverse. With dry valves it handles a little harder. The power reverse will handle slower when there is steam in the valve chamber or the links are frozen or you have dry valves. As to whether it requires any more strength to move it than when everything is regular, I do not know whether I have paid much attention to that in what little operation I have had of them (tes., pp. 3119–3128).

REDIRECT EXAMINATION

As to whether, in cold weather, we use any different kind of lubrication on the valve gear and the hand reverse than we do in the summertime, we have a lighter oil for the links. The lighter oil allows it to flow around to the different parts easier than heavier oil. Using that kind of oil, it has not caused me any unusual effort or any greater effort than it does in warm weather.

874 RECROSS-EXAMINATION

I told you that it worked harder in cold weather than in warm weather, but I was answering the question as to the different kinds of oils. With the oil we use in the wintertime it works harder than it does in the summer.

(Witness excused.)

H. HOEFT, age 45, employed as engineer by the Great Northern Railroad, testified:

DIRECT EXAMINATION

I have been employed as an engineer since the 20th of May 1907. I served three years before that as a fireman. I have been running as an engineer since I was promoted and until the present time. I have operated on the Montana division, Butte division, and Kalispell division, all in Montana. I have operated all classes of service, and types of engines ranging from 85,000 up to 537,800 pounds on drivers. The western part of the country through which I operate is a mountain district. The eastern part of it is a level country. As to what has been the heaviest weight and what type of locomotive that I have operated with the hand reverse lever, that is the 0–7's, 0–1's, the Mikado class, 229,000 pounds on drivers. The lightest I have operated with hand levers is around 85,000, I guess.

As to my experience with power reverse gears, the first power reverse we got was in 1907. That was the McCarroll. We got the Ragonnet next. I have had experience with the Barco. My experience with the Barco was just last year. I began to have experience with the Ragonnet about 1912. We have not had the McCarroll since 1912. We still have the Ragonnet. As to how my time has been divided between the power reverse and the hand levers, I would say about 60 percent hand levers, hand power, and 40 percent power reverse. I cannot say that I have exerted myself to any extent in handling engines equipped with hand levers. I have had
875 hand levers in through freight, way freight, switching, passenger, both local and through.

I have been on long hours of duty with hand lever equipment on the local freight run between Bainville and Scovey, a branch line run. The branch is 100 miles. We had the F–8 class, 184,000 pounds on drivers in that service. That was not a turn-around run. I worked out to the end of the branch one day and back the next. As to what kind of freight I was handling, in the fall of the year that is a great wheat country, and wheat machinery going up. As to how many hours I have put in on that branch run, with the hand lever equipped engine, I would say three months, two and a half months to three months in the fall, 16 hours. When I was doing that I did not experience any adverse effect upon me in any way physically.

When I was on that job I worked when a hand lever was defective. I broke the counter-balance spring one trip, the bolt which holds the counter-balance spring in place. I was about 12 miles out from my initial point. She handled pretty hard on that trip after the spring was broken or lost. I finished out my 100-mile trip. I was not able to get it fixed at the end of the trip; they did not have any machinist up on the end of the line. We have work done on the engines at Bainville. That was my initial point. I ran it back the next day to Bainville. I took my run out following that at the next regular time. I had about eight hours rest. I did not experience any adverse effect physically from that occasion. I have not at any time experienced any interference with the taking or observing of signals or keeping a lookout due to the fact that I was operating a hand lever.

I have done local switching with freight engines equipped with power reverse gears, the O–1 type engine, 229,000 weight on the drivers. That is the same weight as the O engine I mentioned with the hand levers. I have had occasion to do local switching
876 with that O engine equipped with hand levers. I can switch faster with the hand reverse than I can with the O type engine which has the power reverse gear.

I have never been injured or observed anyone receive any injury from the hand reverse lever, or in connection with its operation in any way. I have never experienced any danger at any time in connection with operating a hand lever. I have had the spring which holds the dog or latch in place with a hand lever come out, but I never had any danger I could see. I have had them come out, and I have put them back in again, and the latch would never come out of the quadrant on account of the spring being lost. On those occasions the lever did not move from its position in the quadrant by reason of the spring being lost out. I have never had any occasion in handling the hand lever when I had to call someone to my assistance to help me handle the lever (Tes., pp. 3128–3138).

The power reverse equipment creep, as a general rule, all the time. You get them in a position where you want to work the engine in, but they do not seem to stay there any length of time. I have not had much experience with the Barco. This is mostly Ragonnet that I am talking about. In the limited experience which I have had with the Barco, I have experienced some creeping. I have had trouble with power reverse gears with respect to freezing in the wintertime. I have had them freeze up so that I could not move them until I thawed them out. That occurred twice. One time we were standing still and they froze up before we started. I thawed it out with steam. After thawing it out, I did not have any more trouble with it that day. I never turned the steam into the motor, but used the steam hose to thaw it out. On the other occasion when it froze I was moving. Descending this grade and going up the hill, in order to handle the train, I have to put the reverse lever forward, in forward motion. When I did do this, it was frozen up,

and I could not move it, so that rather than stall, I turned the
877 steam into the motor to thaw it out. That thawed it out.

As to what experience I had after that, the steam and water got into the train line, and froze the train line up. As to what effect that had on the train operation, we got stopped before we got up to the top of the hill. The train line was frozen up seven or eight cars back of the engine. We had 70 cars. We got on up over the hill with that train after we thawed some of the hose out. As to what effect that freezing had upon the way in which I operated the train, we got up to the top of the hill and started down the other side, and it happened we did not get all the hose thawed out on the train line, so that when we got over the hill—we always tried our air there going down the hill—and when I tried the air, I seen the air was not working. We had to let the train go. We had no control of the train, and just let it roll down the hill. We finally got the train under control, got it stopped with the straight air on the engine and the three hand brakes on the head end of the train. That was going upgrade on the other side of the hill. I was not able to control the train with the straight air on my engine and the hand brakes before I got to the bottom of it (Tes., pp. 3138–3141).

June 24, 1931

This occasion I mentioned yesterday where the train line froze up happened about a mile and a half east of Cut Bank, Mont. Twice previously to that the power reverse became frozen. We were standing still at both times. I should judge there was a delay about 25 minutes.

I have had an occasion when the train line froze up when I was operating with an engine equipped with a hand lever. I have in mind an occasion about four miles from Shelby, Mont. I was going west to Cut Bank at that time. I was running no. 3070, and four miles east of Shelby, when I started descending this grade, I tried the air and found out that it was froze up. So I reversed the
878 engine and held it down the hill in pretty good shape. That engine was 229,000 pounds on drivers. I had the hand lever on it. I would say I was going about 20 miles an hour when I reversed it. After reversing it, I used the steam pressure then for braking purposes, to hold my train back on the grade. That is about a one and a half per cent grade, I think, and it extended about four miles from the point where I discovered my train line was frozen.

"Q. On that occasion, were you able to control the speed of your train so as to get down to the bottom of the grade at the speed you desired?

"A. I run by the station at Shelby about six car lengths, I guess."

On this other occasion I told you about last night near Cut Bank, I guess my train was going around 60 or 65 miles an hour when I got to the bottom of the hill before I started up the next hill. I had a freight train. On this other occasion when I had the hand

lever I had a freight train of around 50 cars. Whether, on the last mentioned occasion, had my engine been equipped with a power reverse gear and my train line frozen, as it was on that occasion, I would have been able to have brought my train to a stop there at Shelby depends on whether the power reverse had been frozen up or not. If the train line alone had been frozen up and the power reverse not frozen, then I might have been able to have control of it in the same way with the power reverse. If the power reverse had also been frozen or inoperative, for any reason, I would not have been able to have brought my train to a stop at Shelby.

I would say in real extreme cold weather the hand levers handle harder in the wintertime. As to what we have done to overcome that, they generally supply us with light oil for the link blocks.

They generally furnish us with kerosene. We oil the tumbling
879 shaft boxes and link blocks. As to whether we mix that with the other oil or use it separately, as a rule, as [we] mix it a little bit. As to what effect it has on the handling of the hand lever, it keeps it thawed out and it handles much easier. With the use of that oil, I have not experienced any difficulty in handling the hand levers in the wintertime.

I have observed movement of the power reverse gear or of the cross-head thereof, when the engine was standing and there was nobody moving the operating lever. I was going out of the Havre roundhouse with No. 3216, standing there on the pit. I just happened to look over and noticed the motor working back and forth. Nobody was in the cab at the time. That was around about 1915. I should say it moved probably an inch or an inch and a half. I could not say for sure. That was the cross-head I am speaking of. As to what effect it had an the movement of the valve motion, it would move to a certain extent. Engine no. 3384 was about the worse one we had on the Montana division with respect to creeping. It had the Walscheart Valve Gear and the Ragonnet power reverse. That engine was so bad as to creeping that we had the Elesico exhaust steam injector on her. We would have her set so that the injector would work just about right, but the engine would get to creeping so bad that the injector would quit working

"Examiner ROGERS. What would it do, kick off?

"The WITNESS. Too much steam coming into the injector."

As to how the power reverse had anything to do with that, it would change the cut-off, when the engine goes down into the forward or back motion. As to how that has anything to do with the amount of steam the injector is getting, the exhaust steam injector works a certain amount of steam, going to the valve, and a certain amount of steam going to the injector. That engine would use more fuel when creeping. The creeping on that engine had an effect on my ability to make time over the road. When they creep like that,

so bad, they are losing water, and it gets so bad you have to
879 work the other injector, and you cannot make the distance

with water that you could if the engine was working in proper condition.

As to what extent there is room for me to work on the locomotives which I have operated with hand levers, there is plenty of room on those engines. I have not been cramped in any way in operating them, that is, unduly restricted as to space. In operating them, there are no devices which require me to place myself in front of the hand lever in any way.

As between the power reverse gear equipment and the hand lever equipment from the standpoint of efficiency and economy of locomotive operation, I would say the hand reverse is the best. As between the hand lever and the power reversing gear, from the standpoint of safety, I think the hand reverse is the safest of the two.

CROSS-EXAMINATION

I said I have felt no adverse effect from handling manual reverse levers. I mean that I have not strained myself in any way and have been able to work right along. It has not had any effect on me from the hand reverse. No matter how much handling of the lever I had to do, it did not have any effect on me at the end of a day's work. As to whether I felt any more tired after handling a manual lever on one of these 16-hour runs than I did on an 8-hour run, not from handling the reverse lever; no. As to what it was from, as I said, we were on the job, working 16 hours a day, and practically getting six hours' sleep each night.

"Q. That was the thing which made the difference, the six hours' sleep?

"A. We did not have quite enough sleep. I know that."

The amount of handling I did with the lever did not make me any stiffer in the arms than when I had eight hours of it. I did not feel any stiffer at all in my arms or back from handling the lever. When the counterbalance spring broke on that engine, I handled it the next trip one way, and then all the way back.

881 That run is about 88 miles one way. It would be pretty hard just to figure out how many times I would have to handle the lever on that trip. We would switch at about 8 places. Some places we would switch an hour; some places 30 minutes. During 30 minutes of switching, I guess we would handle the lever on an average of once every two minutes, 15 times or so. In between stations up there we would not handle the lever three or four times a week. The track is so we do not run very fast, and we do not handle it that way. I had an engine, 184,000 pounds on the drivers, on that occasion. When I say I do not go very fast, about all I use the lever is when I start out of the station and stop. That is true generally in my experience on the branch runs. My experience has not been on these runs altogether. I cannot say that most of it has. As to when I last had a main-line run on our road, I am on the main line right now. I have been on that since last November,

when I came back on the main line. I would say that before that I had been away from the main line about five months. I have not been on the branch lines half of the time in the last five years (Tes., pp. 3142–3153).

I have been mostly in freight service on the main line. Some local freight, but mostly through freight. We go all the way from 20 to 35 miles an hour in through freight service. On one of those through freight runs we handle the lever a few times leaving town, starting out. If we have got a few hills, we change the motion. As to whether that is three or four hills, it all depends on the trains we meet.

All the engines we have on these through freight runs are equipped with power reverse. I would say around about 1922 was the last time I regularly ran an engine equipped with manual reverse on a through freight run. I could not say for sure, but it was around in that neighborhood. The only substantial amount of running that I do with manual reverse now is on the branch line runs. I
882 would say that in that service I do not have occasion to handle the lever so very many times when the train is going over the road.

The lever handled harder when I had that broken counterbalance spring that it did over the usual trip. It handled harder when we went to throw the engine in the back motion. It handled harder on the way up to center. I was not either stiff or sore after that trip. I remember I was not any tireder after that trip than I was after an ordinary trip. I said the engine was 184,000 pounds on the drivers.

I told you about the latch spring coming out of the manual lever. I put the spring back shortly after it came out. I should judge a couple of minutes. I guess the train was probably going about 50 miles an hour. The purpose of that latch spring is to keep the latch in place, and also when you unlatch it to put it down in the place where you want to move it. I think it is necessary to have a spring there to hold the latch down in the quadrant.

Most of the trips which we make with a Ragonnet gear they creep. As to what extent they will creep on those trips, some engines are different than others. Some are not quite so bad as others.

"Q. Some of that creeping won't bother you enough to do anything about it, and will go down and back of its own accord?

"A. Well, if they creep at all, they ain't what they should be. They ain't perfect."

If they creep at all, I report them. I have reported lots of them. As to whether I report them on my work report every time they creep, I generally tell the other engineer about it, when he takes the engine from us. If I have the engine back into the home terminal, where the work is done on the engines, I make out a report. I have told Dave Williams that the Ragonnet gear creeps when I delivered the engine to him. I reported it to him in the last month. I also told Pete Kuka and Charlie Nelson. As to where these men live,

883 their residence is at Havre, but they are working out of Glasgow. I could not say that I have reported that difficulty to these men more than once in the space of a year.

We have all Ragonnets in the freight service. I could not just exactly say how many times I have made out a written work report on the Ragonnet gear for creeping or any other cause in the months of June, May, and April. As to whether I have made any out this month so far, I have not worked much this month. I can say that I have last month. As to how many trips I have made this month, I think I made two trips this month. I could not exactly say, without checking up, how many work reports I turned in on power reverse in the month of May. I would say four times at least. I think I made around eight round-trips from Havre to Glasgow in May. I could not say how many reports I turned in in April. I turned in some. As to how many trips I made, it runs about the same. I could not say whether I made four reports in the month of April. We do not make reports every trip. I do not mean by that that the gear does not creep every trip. As to why we do not make the report, the boys are getting tired or [of] reporting them, it seems like. It don't seem to help much. As to whether that is why we do not do it, that is a whole lot of it. It is so regular. As I say, when it gets so bad we do report it. I made one report that the engine should not be run on account of not handling the train the way she should handle. I found the reverse lever not staying in position. I made that out in the month of April, I think.

"Q. Now, in addition to these work reports which you have made out, have you reported this condition to the engineers; that is, Williams, Kuka, and Nelson? That is, are those reports in addition to the work reports which you have talked about, or have the engines gone through in one direction and not in the other?

"A. The engines go through. The engine comes in and goes on through to Willis. Up here until about a month ago, I think they started relaying the engines to Glasgow."

884 We are required to make out a work report at the end of each run. We are to report any defects where the engine cannot take the next train out of the terminal. As to whether we are supposed to report anything that requires work to be done, we do not at Glasgow. They have no machinists at Glasgow. It is just a relay for the engines.

On this occasion when the air reverse froze up near Cut Bank, I put steam into it and thawed it out. It did not freeze any more while I had the engine. I did not attempt to reverse the engine with the air reverse when I was going down that hill.

In the extreme cold weather the manual reverse bar works harder than in the summer. When we use that winter oil it handles just as good as it does in summer. There is no difference at all that I can see.

As to when I observed this creeping on engine no. 3384, that engine acted that way along in April 1931 sometime. I could not say as to

the exact date. It was engine 3384 I had in mind when I was testifying a few minutes ago about making out work reports. I think I have reported engine 3384 twice for creeping, as I recall. I could not say how many times I have had her. We do not have regular engines. We get an engine and sometimes won't have them more than a month apart. As I recollect, I have had her around three times since I have had this through-freight run. The other times she crept, but not so bad. I do not think I reported it the other time (Tes., pp. 3153–3164).

When I said the hand-operated reversed engines were more efficient and economical than power reverse, I had in mind the consumption of coal and water. The power-reverse engines won't use more coal and water if the reverse lever is in proper condition.

I have never been injured with a power reverse. In saying that power reverse is less safe than manual reverse, I base my opinion on this occasion when I was able to use the manual lever as a brake to stop at the station, but there are instances sometimes when the hand reverse keeps you from hitting somebody, or
885 anything like that. I could not say that I have ever tried to use the power reverse for the same purpose.

REDIRECT EXAMINATION

As to what I had in mind in respect to "in proper condition" when I stated that the power reverse gear would not affect a greater use of coal and water if the reverse lever was in proper condition, I mean that if the reverse lever will stay right where you place it, where you want to work the engine. If it would not creep, then I would say the two were about equally efficient.

As to what is done with the locomotives at Glasgow, Mont., right now they clean the power in them, coal them up, send them out on the next train which comes along behind. There is no repair work done there.

(Witness excused.)

H. A. Rowe, of St. Paul, Minn., employed by the Great Northern as locomotive engineer, testified:

DIRECT EXAMINATION

I have been employed by the Great Northern as locomotive engineer since September 7, 1899. I worked four years as a fireman. I have been running regularly since 1899. As to the territory, the first two divisions out of St. Paul, Fergus Falls, Willmar division, Kellispell division, and Rocky Mountain division. As to how far west that territory, including all those divisions, extends from St. Paul, 215 miles one way and 243, I think it is, the other way. That is two different lines. I have been in all classes of freight and passenger service. Not very much switching—local freights. No yard

service to speak of. I have operated practically all the different types of engines that the Great Northern has had during my time, up to the larger size. I have never operated them. Those are mallets. The present engine I am operating is 242,000 pounds on the drivers. That is the mountain type engine, 4–8–2, in pas-
886 senger service. The run I am on now is know as the "Oriental Limited No. 3 and 4", passenger, out of St. Paul, between St. Paul and Breckenridge, Minn. Those locomotives are equipped with Ragonnet power reverse. The largest engine, as to weight on drivers, that I have operated equipped with a hand lever is 229,000 pounds on the drivers. I have been on my present run in passenger service since 1923. I have been operating exclusively power reverse since that time on that particular run. All my experience in operating with hand levers was prior to going on passenger runs. I have never had any power reverse on freight. Prior to 1923 it was all hand lever.

As to what has been my experience as to the amount of physical effort which I used in handling the hand-reverse lever, my physical effort was nothing more than the ordinary operation of a hand-reversed engine, excepting in extreme cold weather, or with a new engine they would work more or less stiff. On those occasions when they worked harder on account of cold weather or being new, I never overexerted myself physically in any way. I have noticed no difference in how I have felt at the end of a day's work with a power reverse equipped engine as compared with one equipped with a hand lever. I was in local service 12 years with a hand-reverse engine, 184,000-pound engine on drivers. That was immediately prior to my taking the passenger run which I have held since 1923. On that local freight run we had some switching to do at all stations. There were approximately 12 or 15 stations where we switched anywhere from ten minutes to an hour and a half. I think that run was 98 miles. The ordinary length of time I was on duty or running over that route was 12 to 14 hours.

I never did observe any injury by a hand lever, or in connection with its use in any way. I have never had any occasion of the hand lever pulling away from me or getting beyond by control in any way. The hand lever is more accurate in maintaining the point of cut-off on the locomotive at the place you put it. My experience with
887 the power-reversed equipment in that respect is it has been more inaccurate in keeping it at a certain place, on account of creeping.

As to what I have encountered in the way of creeping in my operation of power reverse on this passenger run, I have taken a number of engines since I have been in passenger service, and have been troubled with creeping, for causes which they seemed not to be able to remedy at once. Also I have had the air-supply pipe to the reversing cylinders break off, reach rod break, causing delays. I have had this breaking of the air-supply pipe to the cylinders on four different occasions, if I remember correctly. Upon one occasion,

I was making 55 miles an hour when this pipe blew off of the cylinder entirely throwing the engine in full gear. It sounded as though the rods were leaving the engine, but I made a sudden stop, located the trouble and repaired it. As I remember it, the delay on that occasion was about 35 or 40 minutes. On the other occasions, there was a pipe which broke off gradually, and just began leaking, very bad, and unable to supply the main reservoir, when I noticed it at the stations, where I stopped. I disconnected the pipes, took the piece out and screwed another piece back in, causing a delay of about 20 minutes. On this first occasion I do not think the valve motion went into backward motion. It was not near enough to center. It went to the corner in forward motion. As to the instance when the reach rod broke, I was making about 40, 45, or 50 miles an hour, when the engine suddenly threw herself into full stroke, and I stopped immediately, and located the trouble, and raised the link block up and blocked it with wood underneath, and operated, but losing time from there in to the completion of the trip. The engine did not go into back motion on those occasions, she was working too far ahead.

With respect to creeping, it has occurred, I should judge, about one-third the number of engines which I handled on that run.

We do not have the same engine each trip. Sometimes we
888 have regular engines. Now at the present time we have them regularly. Most of the other times of the year we have them in the pools. When I say one-third of the number of engines as my estimate of my experience of creeping, I mean one-third of the number of engines. As to the effect on the operation of these engines when I experience that creeping, you are losing time and causing them to burn more coal and use more water. There have been several causes of creeping; such as a leaky gasket, or any air leak; loosening of the rigging of the reversing gear might cause creeping; or any lost motion in the rigging would cause it to creep. The most common cause is the leakage, I think, in the air piston, or in the piston of the cylinder. You are not able to overcome that on the road to any extent. As to what extent in my experience we have been able to overcome it in the roundhouse, the only experience I would have is making the report on it. I have not had any opportunity to observe the effect of the work which they have done on the individual engines from time to time. It would be very hard to discover the creeping on a reversing gear, when the engine is ready to start. It is only when she is in operation that you can notice this creeping (tes., pp. 3164–3174).

It is necessary to give a great deal more attention to the operation of the reversing gear on an engine equipped with power reverse than one equipped with a hand lever. When the power reverse gets into this situation of creeping, it creeps back, and you have got to push the lever ahead to make it take hold again, and then, when they commence to take hold, it will take hold too hard, and you must pull back, whereas with a manual reverse you put her in a

notch, and she stays there. As to whether I have experienced any occasions where it was necessary for me to take action to keep the power reverse from creeping back over the center, or to the center position, on one occasion, with one particular engine, I had to
889 keep the reversing gear further ahead and not allow it to come near to the center, because it was creeping so bad that if I put it near the center, it might go into the back motion. As to whether I have experienced any delays on account of creeping power reverse, it is not actually the time lost from delays, but it is the loss of time in the run over the division, in losing speed, on account of the engine working too low; or when you are working a long stroke, you are not able to get the speed of a engine that you can when working them at a short point of cut-off. As to what extent I have experienced that difficulty in getting over the road and getting the speed out of my engines on account of creeping, I would say all engines, when they are creeping bad, affect your maintenance of schedule if you have a train with a fast time.

As to my opinion, from the standpoint of economy and efficiency of locomotive operation as between the hand lever equipment and the power reverse equipment, the hand lever equipment is more efficient on account of maintaining the proper adjustment of the gear, where you can operate the locomotive under economical conditions and still maintain the speed. As to my opinion as between the two types of devices from the standpoint of safety, I have never experienced no defect of any kind of a hand reverse gear, throwing herself in the corner at high speed, while I have had the same effect with a power reverse, which is liable to break down. I never had or never experienced any case of the hand reverse throwing herself back toward the center or anything of that kind which you have with a power reverse.

CROSS-EXAMINATION

I am a member of the B. of L. E. The speed I had in mind on the occasion when the power reverse went to the corner at high speed was 55 miles an hour. That was one occasion when the supply pipe of the air cylinder blew off of the cylinder where it is attached to the reversing gear cylinder. I have had
890 experience running at these speeds with hand-operated levers.

I have run occasionally hand lever engines in passenger service. It was about two months of the eight years that I had been on hand lever engines in passenger service. My experience in running at high speeds is confined to those two months, when my engines were equipped with manual levers. I did not run at what you would call high speed when I was in local freight service between stations. It was about 30 miles an hour.

I have never actually experienced the engine going into reverse of its own accord on power reversed engines. I have never measured the amount of coal or water that a power reversed engine would con-

sume when it creeps over what it normally uses; no way of measuring it. The only way I could estimate it is by observation, when you take coal or take water. I have never observed any particular amount; only to the extent when I was troubled that way, I was using more than when running in perfect condition.

Going back to my experience on these local freight runs where I had the manual reverse, if the valves would become dry, or the engine was new, they would handle harder than after the engine was properly lubricated or had been in service some time. When I was doing switching and had valves get dry I always used two hands to throw over the lever. I always use two hands anyhow. In starting out at the station, when I had hooking up to do, I would use two hands in that operation. As a matter of habit, it is customary with me to brace my feet against the boilerhead, or some other object I had there, for that purpose. That would give you a better purchase on the lever. As to whether I would keep my balance better, there is nothing really to balance. It is more of a habit. It is the practice in doing it.

I have never had a counterbalance spring to break while I was handling the lever. I have never had any piston rings to break while I was handling the lever. I have handled slide valve engines. As to how the amount of strength which I had to use
891 to handle the engine equipped with the slide valve compares with handling the lever on a piston valve engine, they will handle harder, especially if the valve is a little bit scratched or cut, as we call it, or you break a strip spring. I have had that happen. I have experienced a jerking motion with those slide valve engines when handling the lever. I would not really call it a jerking motion, but more of a rattling motion, when the engine becomes dry or when an engine has got a dirty boiler, or it might do it with the old slide valve, strip spring was broken. I am referring now to the action of the lever in the quadrant with the engine running along. As to whether that rattling has a tendency to make the lever come back out of the notch, I have never had the lever come out of the notch. I never feel any obstruction when I am handling those engines, reversing them. I have handled slide valve engines all the way from the Standard up to 80,000 pounds, I think the larger are, with slide valves. With the exception of the 2 months that I put in in passenger service with the manual reverse, my experience with the hand-operated lever had been confined to this local and through freight work.

"Q. I think you said that the speed you generally made on those trains was about 30 miles an hour, the highest speed?

"A. Ordinary freight speed."

I was never injured by a power reverse gear. During these four or five instances when either the air pipe broke or leaked, or the reach rod broke, in none of those cases did the hand-operated lever in the cab move out of its position in the quadrant; it is impossible.

And in none of the cases, except breaking the reach rod and the pipes, did anything else on the engine break, as a result of those power reverse instances.

With reference to these engines on which I have experienced creeping, I do not get creeping on each trip. There may be many trips, after they have been in the shop, when they act all right. As to whether I have had any creeping on the engines that have
892 been regularly assigned to me, we have no regularly assigned engines, excepting in the last few months. I have had some experience with them creeping, but not as much as where you are running other engines. As to how many times I have reported creeping in the last three months, there was one engine I have particularly in mind which I reported every trip for two weeks straight. That would be five trips. She did not go to the shop. They overcame it in the roundhouse. I have not had that engine since; it is on the other line, western division. I have had trouble with other engines creeping, but not as bad as this one. It seemed like on some of these engines, where we were troubled more or less with the creeping, it seemed if they did repair them, they would not hold up. They would go along for a while and start creeping. This one engine was no. 2515. I did not discover what the difficulty was, but it was finally overcome. As to how many other engines I have had on which I found creeping in the last three months, I cannot recall the engines just now, because I never made no record. This no. 2515 was not the only one on which I made out work reports. I should say I have made out work reports in the last three months on about one-third of the different power reverse engines on the run in addition to no. 2515. It is a very common occurrence, and a very common practice to report reversing gears creeping on this class of power. I have never kept a record of the amount or the number I have reported. I do not remember reporting any this month, June, because I have had the same engine this month. I have had no difficulty with that. I think I reported on three or four different engines in May; three or four different work reports. I made ten trips a month. As to the month of April, I cannot say; I do not remember (tes., pp. 3174–3185).

As to how old the reverse gears on these engines I am talking about are, they came there in 1923. They were on the engines when they came there. They are still the same gear in the engines now.

893 [File endorsement omitted.]

I have never run anything but the Ragonnet. I am able to maintain my schedules on that Oriental Limited as a general thing under ordinary conditions. It is impossible for me to remember how many times I have been late in the last year. I have been late in the last three months. I lost my time on those occasions on account of heavy train and station work. These occasions when something broke and I was tied up for 15, 20, or 45 minutes repairing

them are not the only times when I have been late on my schedule and traced the trouble to the power reverse; I have been late a number of times since I have been on that run, on account of power reverse creeping, but there was no delay from stopping the train to repair it, but it was on account of not being able to maintain speed, on account of the lever not staying in the position where you put it, or the valve gear. I cannot remember any such instances. That is over a period of eight years. From 1923 is a long time to remember. It would be as much as once or twice a year, more so especially in extreme cold weather. In extreme cold weather we do not have more difficulty with the engine standing. Of course, you use more coal to maintain the steam pressure, because the trains always handle harder in cold weather. I think we experience more creeping in cold weather than ordinary weather. When power reverse is not creeping—that is, if it is in perfect condition—it is not necessary to give it any more attention than you would a manual bar. By " perfect condition " I mean so that it is not creeping. I do not think it is a quicker and simpler movement to adjust the power reverse lever than it is [to] handle the Johnson bar in the cab. It is slower. In fact, I would say there is no [not] much difference in making the movement of either one, between the two valve gears, when you are only making a movement of one or two notches, like opening them up to start out. You can hook the power reverse up and still at the same time keep your head out of the window and on the track. You can do that with a Johnson bar. You can sit with your head out of the window
894 and at the same time hook one of them up. As to whether it is ever necessary to bring your head in in order to reach for the bar, I have never had that experience with them.

(Witness excused.)

FRANK O'NEILL, of St. Paul, age 49, weight 160, employed by the Great Northern as a locomotive engineer, testified:

DIRECT EXAMINATION

I have been in the engine service of the Great Northern since 1900. I served as a fireman three years. I have been running an engine ever since 1903. I have operated in the St. Cloud division, Willmar division, Northern division, Dakota division, and Kellispell division. Those divisions take you west from St. Paul to Fargo, N.D., 242 miles. As to how my time has been divided as to the classes of service in which I have operated, from 1903 to 1922, it was freight service; 1922 to the present time, passenger service. My freight service during the 19 years includes through freight service, except three years local service. I have had no yard service. I have been in through passenger service during the last nine years. On the run I am on now we handle two runs, no. 7 and no. 8, the Winnipeg run and no. 1 and 2 the Empire Builder. Those are both fast trains.

As to what power we have on those runs, part of them are hand reversed and part power reversed. The size of the power reverse engines is 242,000. They are the Mountain type engine of which Mr. Rowe spoke.

The size of the hand lever equipped engines is 164,000, I think. They are a Pacific type engine, 4–6–2. The largest engine which I have operated with a hand lever is the class " O ", 229,000 pounds on the drivers. It was in freight service that I used that.

My experience with power reverse gears began in 1923. I had had exclusively hand levers prior to that time. Since 1923, I should judge I have had the hand levers about 60 percent as compared
895 with the power reverse. I get about 4,800 miles a month mileage ordinarily. I have had experience with the Ragonnet type of power reverse gear.

I have never received any injury or observed any injury to anyone else, on account of the hand operated reverse lever, or in connection with its use, in any way. I have not over-exerted myself in any way in handling the hand lever. It has never had any effect upon me physically, in any way, that I have noticed. As to the handling of the hand levers in extreme cold weather as compared with the remainder of the year, in extreme cold weather a lever will handle harder, but our company furnishes a light oil and also kerosene, and when you lubricate the parts, why, there is not any difference. As to the amount of clearance or room that I have had in the cab in operating the engines equipped with hand levers, the class of engines I run, there is plenty of clearance. There are no occasions in the course of my operation of a locomotive which require me to place myself in front of the hand lever. There is nothing I have to do which places any part of my body in a position where I would be struck in case the lever moved unexpectedly. In my experience, I have found no difficulty in keeping a lookout or taking or observing signals due to the operation of the hand lever.

You can keep a fixed cut-off with a locomotive on a hand lever. As to my experience in that respect with power reverse gears, in some cases creeping will cause them to act so that you cannot keep a certain cut-off. As to what extent I have experienced that on my runs, when we first got this power reverse I think in 1924, I noticed creeping in cold weather. It was quite prominent then. I have not noticed much creeping lately, as we do not have them so very much, you know. We have a different engine each trip. As to whether we have hand levers about half the time and power reverse about half the time, we have the hand lever a little more than we have the power reverse, at the present time.

896 I have had a specific occurrence with the power reverse gear which interfered with the operation of my locomotive. On no. 730, coming east on train no. 2, between Brandon and Garfield, running at the rate of 50 miles an hour, we broke a connecting rod over stripped the threads on the connecting rod, where it goes into the cross-head arm, causing the engine to reverse in the backward motion

and forward motion about three or four times, before I got the train stopped. I refer to the cross-head of the power reverse. As to the effect on my locomotive, it felt as if the engine was off the track, very noisy, just as if she was up off the rails and then down again. I stopped my train immediately, as soon as I could. I was able to get into the next station with it. I made repairs and took the train through. As to how I made repairs, there were threads enough left on this connecting rod to screw it in again. There was 35 minutes delay as a result of that. I would say I was about 3 miles from a station when it occurred (Tes., pp. 3185–3195).

Referring again to occasions when I have experienced creeping, as to what effect that has upon the operation of the locomotive as you are going along the road, it makes a very uneven movement of your train. She will first creep down and back, and she comes up against your train and runs forward again, making it very hard to maintain your schedule. I could not say what effect it has on the movement of the train behind the locomotive. The way it acted on the engine, there must have been some jerk to the train.

As between the two types of reversing gear, the hand lever and the power-operated type, I think the hand lever is more economical. From the standpoint of safety, my view is that they are about fifty-fifty.

CROSS-EXAMINATION

I have never had any parts of the valve motion or reversing gear to break when I am handling a train equipped with manual
897 reverse. The reach rod on the manual-reversed engine does not have threads on it and is not threaded into the mechanism up by the link block. It is bolted. If the bolt which connects the reach rod to the tumbling shaft were to shear off while the engine was running at high speed, it might have some tendency to shake the lever. I do not see any difference in safety between the Johnson bar, the long lever in the cab, and the short hand lever you have on power reverse. If some part of the engine were to break and strike the reach rod of the manual reverse lever, and cause the lever to come out of the quadrant, I think it would be as safe in the cab with that kind of lever as it would with a power reverse lever. There would be no more danger of my being struck with a long lever, the size of the Johnson bar, than there would be with the short size of Ragonnet levers. I have got plenty of clearance in there. It is my testimony that I have never been anywhere in the cab where the Johnson bar might have struck me, if it had come loose.

"Q. That is why you say that you consider one as safe as the other, because you have never been in a position to get in the path of them?

"A. You are liable to get hurt with either one, just the same as you are with any other part of the engine."

Not having any experience, I cannot answer in what way you can be hurt with the power reverse lever. I did not have in mind any way I might be hurt with a manual lever. I have got down in the deck of the locomotive while I was running along and gone back for a drink of water, or something of that sort. As to how I do that without getting in the path of the reverse lever, I go right back of my lever. We sit behind our reverse lever. If the lever should come back while I was crossing over the quadrant, I do not think there would be any danger to me. I have got plenty of clearance. I have never stepped across the quadrant while the engine was in motion since I have been running an engine. As to how I examine
898 my lubricator, our lubricator is out on the back end of the boiler-head, on a bracket. I can see that from my seat box. As to whether that is where I always observe it from, I might stand up to see it. I stand right up in my seat to look at it. As to whether I have ever stood anywhere else than my seat to look at the lubricator, before starting, if the engine is standing still, I might stand up on the runningboard. Not when the engine is in motion. I have not stood on my seat box, but right beside it. It would not be more convenient to stand on the quadrant. The quadrant is not in a position where you would get a better look at it, if you did stand on it. I have never been on an engine where the quadrant was so located that, if you would stand on it, you could see the lubricator better than if you stood on the footboard; if I stood on the quadrant, I would be too high. The quadrant is right alongside the boiler. I could not give you the exact height the lubricator is from the footboard. It is not higher than my head on the class I run, this H-4 class. I think the weight of that is 164,000 pounds. The quadrant is located alongside the boiler, up in front of me. The space between the quadrant and the side of the cab ranges from 15 to 21 inches. When the lever comes back in the extreme rear motion there is 15 inches between it and the side of the cab. I call that plenty of clearance.

I have worked on locomotives where the back end of the quadrant is back of the boiler head. I could not say just how far it extended back. The front end is attached up just at the side of the boiler head. As to how far ahead of the back end of the boiler head it is, I should judge it was about fifty-fifty, half-way up on the boiler. You have just about 18 inches back of the boiler. I think that is the only class on which I have operated in my 28 years of running on which the quadrant extends back of the boiler. All the rest of them are up alongside the boiler. They are not deckless engines.

899 On this occasion when I stripped the threads to the connecting rod of the power reverse, nothing broke about the engine. I have never been called in for rough handling of a passenger train. I operate passenger trains. I have never been called in for delay to my train on account of power-reverse creeping. I

have never been called in about using too much fuel when power reverse was creeping.

I am a member of the Engineers' Service Brotherhood. I have never heard any discussion of the matter of power-reverse gears in my local division. I have never heard any complaints made by our committees against power reverse. I have never complained to the committees about power reverse being on my engines. I have never complained to anyone about power reverse being on the engine.

REDIRECT EXAMINATION

I have never heard of any complaints about hand levers. On these locomotives where the quadrant is located alongside the boiler-head, the engineer's seat box is back of the hand lever when it is in the extreme backward motion. I could not tell you exactly how far back of the lever. As to how far in front of my knees the hand lever is when it is in the extreme backward motion and I am sitting on my seat facing forward, there is clearance there, but I do not know exactly how much. When I say there is a clearance there, I mean there is room for me to get out behind the lever, without being struck (tes., pp. 3195–3206).

(Witness excused.)

T. W. INGRAM, age 38, of Columbus, Ohio, employed by the Norfolk & Western, testified:

DIRECT EXAMINATION

I was first employed by the Norfolk & Western in 1912 as a fireman.

I was promoted in 1919. I am firing at the present time. The
900 lightest weight on drivers of the locomotives I have operated that were equipped with hand reverse is 106,780 and the heaviest is 221,780. I have operated engines equipped with power reverse. The range of weights on drivers of the engines so equipped is 354,500 pounds to 478,000 pounds. Since the time I was promoted I have had both hand and power reverse. As to what portion of the time has been on hand reverse and what portion with power reverse, I would say about 50 percent. All these power-reversed engines I handled were 354,000 Mallets.

"Q. Then they are all Mallets equipped with power reverse?

"A. The heaviest I handled with hand reverse has power reverse on it now, but I never handled one of them with power reverse."

I have never seen an accident with the hand reverse. I have never had an accident myself from a power reverse. I have seen one which occurred May 2, 1927, in the Columbus, Ohio, yard. The engine was no. 1388. We were switching the coal dock at Columbus and there was a Pennsylvania cut being delivered to our yard over their lead, and we pulled down to make a switching movement and stopped about a car length in the clear of this Pennsylvania cut

to allow the brakeman to walk behind the tank and throw the switch so we could back up. The engineer stopped and put the reverse lever into back motion so that he could back up as soon as the brakeman threw the switch and threw the signal. The brakeman did give a signal, and he released his brake and opened the throttle and the engine went ahead. The operating lever was in back position. I yelled at the engineer to stop her. We were close to this Pennsylvania cut. This Pennsylvania cut was on my side of the engine. So he opened the throttle a little more. I yelled at him to put the brake on. I saw that we wouldn't get stopped short of getting into this Pennsylvania cut, so I ran over and put the automatic brake handle in emergency position and I got off of the engine on the right side. He got into the cut of cars. They were
901 moving. And it pulled the main reservoir on the left side off, that is, it tore one end loose from the boiler and pulled the studs that hold the straps out of the boiler. I was the fireman on that engine. That was a half deck engine, I imagine you would call it. It is an open deck engine. I was in a position to see what the engineer did. That engine was equipped with the Ragonnet type of power reverse gear, I believe. Nobody was hurt. I don't think that accident could have happened with the hand reversed engine, not on that type of engine. I had run that engine on previous occasions. It did not function normally. It crept. The gear crept and at times you would pull the reverse lever in back motion and the gear would not change the valve, it would not throw the valve gear over, that is, when you would pull the lever from forward motion to back motion it would not put the valves in back motion

I have fired locomotives where the power reverse gear crept. As to whether there is any effect from the creeping on the fire, I have noticed some. I noticed that it is harder to maintain a fire. I find that it burns more coal. As to the relative economy in operation with hand-reversed engines and the power-reversed engines, I believe the hand operated is the most economical. As to the relative safety as between the hand reverse and the power reverse, the engines we have equipped with the power reverse could not be handled with the hand reverse. As to the other engines that are equipped with the hand lever, I don't see where there would be any difference. I think it would be just as safe with the hand lever.

I had this engine no. 1388 after this occurrence about which I told you. I have had it on several occasions since then, but I don't know how long it was after. I think the Ragonnet gear is still on her.

902 CROSS-EXAMINATION

I am not a member of either of the brotherhoods. I would say altogether I have had about four years running experience. About 75 percent of that has been on these Mallets, I imagine. That has been in yard service. All of my running experience has been in

yard service. We use the Mallets in yard service for switching and transfer work. All of my experience with the manually reversed engines has been in the yard. As to what size engines I have had the most experience in the yard, most of the running has been with the Mallets. The size and type engines of the manual reversed engines I have run the most are 147,000. That is in yard service. That was [as] an engineer. As to how long I worked with those engines, I never had one regular. I was on the regular list practically all the time. I couldn't just state exactly how long it was. I imagine out of the entire time I would say about a year, or ten months or a year. All my firing experience has not been in the yard; five years on the road. I was firing the same size engines, the 147,000 and the Mallet 354,000. I had the Mallets firing on the road. That was in through freight service.

I do not know how much air pressure we had in this Columbus yard when the engine did not reverse itself. You could not handle one of these Mallets with manual reverse because practically you have two engines under the one boiler. There is too much valve gear there for you to swing over. It would be too heavy and too hard to handle.

(Witness excused.)

F. SCHALLER, age 49, employed as locomotive engineer in the New York division of the Pennsylvania Railroad, testified:

DIRECT EXAMINATION

I entered the service July 21, 1900, as a locomotive fireman. I was promoted to engineer in August 1907. I have been
903 engaged as an engineer in all classes of service—yard, freight, and passenger service. I have been operating as an engineer practically ever since 1907, with the exception of 1915 to 1923, at which time I was general air-brake inspector. I have operated the bar lever, hand operated, the screw hand operated, and the power reverse gear of the Alco type, G and E types of reverse gear. I last operated a hand-bar reverse lever approximately 16 years ago. That was in passenger service between New York and Philadelphia, also on the New York and Long Island Branch Railroad between Jersey City and Point Pleasant (tes., pp. 3206–3217).

I have never sustained an accident in connection with the operation of the hand bar reverse lever. I have never observed any such accident. Ordinarily I do not have any trouble in operating a reverse bar lever. I have had trouble at times. We get engines out of the shop after having received class repairs or perhaps prior to starting out on your run they may work hard. All these conditions I would have corrected prior to leaving the terminal. I surely have had difficulty with dry valves. To correct that condition, I feed more oil to the valves through the lubricator. I have never had to call for assistance in moving the reverse bar. I have generally

operated either type of reverse gear, the bar, the crew [screw] or the power reverse gear, with both hands. As to why I do that, with the bar lever it requires part of the strength of your arm or hand in closing the latch. It makes it much more convenient to assist that hand by using your right one to pull it over. With the screw reverse gear you have a latch and in revolving the screw reverse gear it is easy to place that latch in the slot. With the power reverse gear a notch or two may mean a whole lot in the cut-off of the engine, so after pulling a locomotive up and you want to change the adjustment I usually place my hand down to feel just whether I am moving it one or two, using my right hand for that and moving it with my left. It gives me a more accurate adjustment.

904 I do not recall that I have ever had to use so much effort in the operation of the power reverse lever that I became exhausted or fatigued. With the screw reverse lever several times in taking the slack I have gotten out of wind. It did not interfere in any way with my duties.

There are adequate clearances on all of our locomotives with the hand bar reverse. I have never caught my hand or finger or elbow or any part of my body in operating the hand lever. The quadrant on the hand bar engine is generally placed on the right hand side of the locomotive and fastened to the boiler, that is, to the right hand side of the boiler. It is in front of me and to the side. The foot brace is fixed approximately in line with the front end of the quadrant. I do not recall ever having any trouble with the hand bar reverse gear going down into the corner. I have never had any trouble with too much oil on the quadrant; or worn piece.

I have had trouble in starting the hand bar in motion due to too much steam pressure in the cylinders. Perhaps the train would not start when you would open the throttle at the station; your cylinder would be full of steam and you could expect it would work hard to pull her back against the steam pressure. I have opened the cylinder cocks then. I have never had any trouble whatever in getting the lever back then, or forward, as the case may be. The remarks I just made are directed generally to the several types of locomotives I have handled with the hand bar and various types of reverse gear, including switching and freight service. I am now engaged in interdivisional passenger service between New York and Washington, or between Manhattan Transfer and Washington. When I was in the switching service I never had any trouble in seeing signals due to the manipulation of the hand bar. I have never missed any signals on that account.

905 I had never had any experience with the air-power reverse prior to my present passenger experience. I have had experience with the air-power reverse. I would not say to any great extent. However, I have had a few cases of creeping quite bad. I have had cases where it has crept moderately, not really a reportable condition. The effect of creeping on the locomotive makes it difficult

to maintain your schedule; it is hard on the fire, and it is hard on your water. As to what I mean by hard on the fire and hard on the water, you place your engine at a certain cut-off expecting it to stay there, which would really take care of your schedule. By creeping it may go down perhaps ten or fifteen percent or better in the cut-off, which would immediately work much harder on the fire and, in addition, cause a larger consumption of water. Then if she worked over into back gear that condition would stop, but you would get a severe shock to your train due to the engine bucking.

I have had an experience of the air reverse going into reverse. I recall a case some time ago. I cannot give you the date. It was at the top of what is called Lawrence Hill on the New York division, approximately eight miles east of Trenton. The engine started bucking, and I immediately placed the reverse gear further ahead, knowing that she had been creeping slightly above that, and I continued on through. This corrected the condition. I recall a similar case approaching between North Philadelphia and the Schuylkill River. The very same condition existed, and I corrected it as stated.

As to my experience with maintaining a fixed cut-off with the hand-bar reverse, it is positive with the hand-bar reverse lever or with the screw reverse. I have had trouble in maintaining a fixed cut-off with an air-power reverse. When the air-power reverse creeps you cannot maintain a fixed cut-off.

As to whether I have had any experience with the air-power reverse gear breaking down completely, while riding on a
906 locomotive while conducting draft-gear tests on the cars I was making observations of the locomotive, and when approaching Elizabeth Station, New Jersey, the pipe between the supplementary reservoir and the operating valve of the Alco power-reverse gear broke. Of course, the train stopped, due to the leakage being so great that the air pump did not overcome the leakage. There was a train consisting of 12 passenger cars attached to the engine. This occurred between South Elizabeth and Elizabeth Station, on the New York division. As to what I did after I observed the broken pipe, it was dark and I got off the engine to determine where the leak was, and I discovered it, and I requested the fireman to hold the broken pipe pieces together. It does not require a whole lot of air pressure to operate the Alco power-reverse gear. And he did this. Prior to his doing that I had closed the cut-out cock in the supply pipe to the supplementary reservoir so no air would go in there. But after the fireman held those pipe together I turned it on gently. The engineer had the understanding that he was to reverse the engine to take slack of the train in order to start when I gave him the signal to do so. So when the fireman was holding the pipe, and I turned it on easily, he was able to reverse the locomotive. He took sufficient slack and then the fireman and I performed the same operation while the engineer reversed the engine in the forward position. The fireman and I both got on the locomotive and the engineer started the train. Of course, it is to be

understood that the pipe was still broken, although the cut-out cock leading to the supplementary reservoir was closed. The necessity of taking the slack at this point on a 12-car train is due to its being an ascending grade on a curve. It was necessary for the fireman to lie on the foot board or running board when he was holding this pipe together. If this engine had been running light and that air pipe had broken, the only way we would have had of stopping the
907 engine would have been with the hand brake on the locomotive tender. Your air brakes would have been inoperative until after you had stopped and closed the cut-out cocks leading to the supplementary reservoir. But you really had no means of stopping other than the hand brake on the tender of the locomotive.

I have operated manually operated screw reverse gear. I operate that most of the time in my present passenger service. The rest of the time I operate the air power reverse. As a result of my experience in this passenger service with the air power reverse and the screw reverse, I am able to give an opinion as to the comparative efficiency of the two gears. In this particular service I prefer the screw reverse gear because the cut-off is positive, it is easy to adjust, and you can regulate your cut-off to compensate for the ascending and descending grades. In other words, I make a smoother run over the trip. I can give you an approximate idea of the relative time it takes to reverse an engine with the three types of gears. I would say with the hand bar lever approximately a second, with the Alco type of power reverse gear two seconds, and with the hand screw type reverse five to six seconds.

CROSS-EXAMINATION

On this occasion when the air pipe broke the engineer stopped the train satisfactorily by lapping the air brake. It would have stopped anyway, being due to the air compressor not being able to compensate for the excessive leak. That would set his brakes had he not lapped his brake valve. It would have been more positive if he had lapped his brake valve. It would have been, I imagine, a quicker stop. Of course, that would depend upon the rate of leakage and the frictional resistance in the air brake pipings (tes., pp. 3217–3227).

As to whether I have observed the power reverse gear creeping when I had dry valves, it would not hardly be noticeable. There is
908 very little relation, if any, between dry valves and the power reverse gear creeping. I would say that there is no relation, because there is no admission lap with the power reverse gear and what little creeping that would do, why, the valve fluctuates ordinarily and it wouldn't mean anything. There is a relation between lost motion in the parts of the link motion and the creeping of the power reverse. But that is balanced by the cushioning of the piston valve of the air piston of the power reverse gear. The play and the force that is generated by the lost motion of the link motion parts is easily compensated by the cushion of your power reverse

gear in view of the fact you have no admission lap in your operating valve. That cushioning effect would not produce some of this creeping I talk about when the force is on that because it is cared for in the piston. The power reverse air cylinder absorbs the force. It is not transmitted back to the locomotive cab like it is with the hand or screw reverse gear. In the same way it would take up the force of other disturbances in the steam chest, which makes it a sort of a dangerous proposition, for this reason: We are running along at 60 miles an hour or 70 miles an hour, the maximum speed. Now, that same condition arises as you stated, broken valve or radius rod broken, or something of that nature. With your hand bar or screw reverse gear—Well, I am a little ahead of the story. The natural position of an engineer is resting his arm on the arm rest looking out the window. With your hand bar or screw reverse gear as soon as anything happens, such as a broken valve or any other parts breaking, it is transmitted immediately to the reverse lever in the cab; you hear the rattling sensation there on the screw or the bar. That attracts your attention to that particular point. You will pull your head in instantly. With your power reverse gear you don't know that until something flies off and hits you alongside of the head, because there is no forewarning.

"Q. In other words, with the power reverse gear there is no danger of getting hit with the lever because the lever remains stationary in the quadrant?

909 "A. I do not see any danger of getting hit with the lever, anyway."

As to whether the power reverse hand-operating lever remains in its position in the quadrant, I have never had the experience, but I imagine it would. As I said, the force is taken up in the air cylinder. It is cushioned there and is not transmitted to you, so you would have no warning. With the manual reverse that force is not taken up with any air cylinder, but it is communicated all of the way back to the hand lever in the cab. You have the force from whatever disturbance there is in the link motion with the valves transmitted back on the Johnson bar. As to whether I think it is a safe situation, if a radius rod would break, to have the force of that breakage come back against the hand-operated lever, you understand your complete force is not thrown back against your hand-operated lever. The point I brought out was that there was a warning there; there is a rattling noise—br-r-r-r-r-r!—similar to that, indicating that something is wrong. Such as dry valves, or conditions like that; and there you would get the warning. The reverse lever is a warning, whereas with the power reverse gear you have no warning at all. As to whether you can tell from the engine exhaust whether the valves are getting dry, it is a difficult thing to do when going along at a high rate of speed. You cannot tell that by your exhaust. If your engine is dry you may have to work at a greater cut-off in order to maintain your schedule. You could tell if the engine got crippled and going at 60 miles an hour, on one side, due to the inter-

val between the exhaust, getting two instead of four. As to whether you could tell from dry valves or the broken radius rod, you would not know what the particular defect was or what was responsible for it, no. It is simply a barometer to tell you something is wrong.

In my judgment, the cause for the power reverse creeping, in my experience, is principally lost motion in the operating parts
910 of the power reverse gear. If all of the lost motion is taken up, you would not have trouble with the creeping and the leaks compensated for. As to how you would compensate for the leaks, perhaps your stuffing box gland is leaking on the front end of your cylinder. You would tighten up on that. The piston packing would not mean a whole lot because you have no admission lap, and if there is the least bit of leakage there, in view of the operating valve or the rotary of the operating valve having no admission lap, you practically have a main reservoir there, or main reservoir pressure there, regardless of whether there is a leak through there or not, at all times other than when you have moved the reverse lever to forward or back position. At that time you feed your main reservoir air through one side of your piston to compensate for the displacement that takes place due to the exhaust from the opposite side of the piston to the atmosphere. As soon as your floating lever has equalized, it laps your rotary valve again and balances the pressure on each side of your piston.

I have had trouble with these hand operated screw reverses prior to starting out on my run. I have found cases while on my run where they would get a litle dry and bind slightly, but not enough to create any undesirable condition. I have always been able to handle them without putting my weight on them. I never have to lean on them to get them around. I never have to exert any undue effort. There is a slight amount of lost motion in them between the cross head block and the worm; but that does not mean anything. It is not great enough. As to whether I have to take slack with them before I start, and then they start with a jerk, I have never experienced that. I have never experienced enough lost motion that they started to operate the gear as soon as I turned them.

"Q. You never had them jerk you when you were going around, where you would make two or three turns and then have it stop with a jerk?

911 "A. No; I have not. Now, hold on—unless I draw them all of the way back against the back of it and then, of course, that would be expected.

"Q. How long have you had these hand operated screw reverses?

"A. Well, I have been operating since 1923, since I went back running."

I have not observed that the company has taken some of them off and put other types of gear on the type of locomotives we run. They have not done it on my respective division. I have never observed them take any of the screw reverse gear off on the passen-

ger types of locomotives. I have heard they took them off other types of locomotives, but I don't know.

(Witness excused.)

C. E. VERMEUL, age 43, employed as locomotive engineer in the New York division, Pennsylvania Railroad, testified:

DIRECT EXAMINATION

I entered the service in November 1910 as a fireman. I was employed [promoted] May 1918. I have operated in local freight, through freight, and yard service. From 1918 to 1925 my time was spent in local and through freight; 1925 to the present time it has all been yard service. I have used all three classes of reverse gears. I use all three classes in yard switching. I get about 50 percent power reverse and about 50 percent with the screw and air reverse. I do not get more air than screw reverse in switching service; it is about even.

I have never sustained an accident in any way in connection with the hand bar reverse gear and I have never observed any. As to what has been my experience with regard to my ability to operate hand or power reverse, I would sooner have the bar reverse in yard service with a small type engine. With a screw reverse in yard service on a flat job for eight hours your arms are pretty well
912 tired. The air reverse I only had on a hump job. I have had trouble with the air reverse in yard service creeping on a heavy drag; you would have it creep from the corner up, which would retard the shoving of the train. I have never had any difficulty with the hand bar reverse working too hard. I operate the hand bar reverse with one hand and sometimes two hands. I have never had to call for any assistance in operating the hand bar reverse (tes., pp. 3227–3237).

I have never had any experience with engines just out of the shop. They are fairly broken in before I get them. My hours in switching service are 8 a.m. to 4 p.m. I have never been overtired or physically fatigued at the end of a day's work when operating a hand-bar reverse. Quite frequently I go to the twilight ball games. I have never had any experience with the hand bar jumping out of the quadrant. The hand-bar quadrant on my switching engines is on the right-hand side of the locomotive, bolted to the boiler. The foot brace is about the center of the cab, between the back and the center front of the cab, about center way, I would say. As to the clearance around the hand-bar reverse in the cab, between the bar and the boiler, I would say there is about four to five inches and about a foot and a half from the bar to the side of the cab. I have never had insufficient clearance to operate the hand bar. I have never got any part of my foot or hand or body caught by hand-bar reverses. I have never had any trouble in getting signals in switching service in the use of the hand bar. I

have never missed any signals due to the use of a hand bar. I have never been reprimanded or disciplined for missing any signals due to the hand-bar reverse. I have never had my attention called to missing any signals. So far as I know, I have never had any unsafe conditions in operating the hand-bar reverse.

CROSS-EXAMINATION

I have used the B type of engine in switching service with the manual reverse. The weight of the B type is 180,000 pounds, approximately. The position I take as an engineer when I
913 am engaged in switching operations is sitting forward, facing the head of the engine. I get signals from the rear by looking around out through the side cab window. As to where the quadrant is with relation to my knees when I am sitting on my seat box, the back end would be about two feet beyond my knees, along my left side. I should say the quadrant is about two and a half feet long, roughly. I never measured one. I don't know. The center of the quadrant is forward of my knees. I should say the length of the hand lever above the quadrant is about two and a half feet to three feet. I never measured it to be exact, and I couldn't tell you. When the lever is in full forward position and I am seated on the box, I would say the top end of the lever is about three feet from my knees.

When I am getting a signal from the rear I put my right arm on the arm rest and look out through the cab window to the rear. I would not say that from that position you could reach the manual lever if it is in full forward motion. As a matter of fact, you could not. In order to reach my lever I must come inside the cab. If I had received the signal to back up, I would just reach over and pull the lever over with my left hand to reverse the engine. That brings me well inside the cab when I do that. I don't know that I have had the ground man change his signal during the operation of the reversing of the engine. After I pull the lever over I look to see what kind of a signal I am getting. I always get the signal again before I move the engine. My engine is in back-up motion with the lever in reverse. I am still getting signals from the rear and I get a signal to go ahead. From the position I am in in getting the signal, very likely you would have to pull your head inside the cab again to get into full forward motion. You would have to come inside to get it all of the way down in the corner. Then I would have to turn back again to see my ground man and get my signal again before I moved.

I have done switching with the power reversed engines only on hump jobs. That is right straight ahead moves. I sit down
914 when I am doing that. We have the Alco type of power reverse. The operating lever is bolted on the side of the boiler. As to whether it is any better within my reach than the manual lever, I should say it is about the same distance. It is

within your reach. You can reach over and shove it ahead and draw your head inside of the cab. I think you would have to bring your head inside the cab in order to push the lever into full forward motion.

(Witness excused.)

J. H. HAINE, age 58, weight 145, employed by the Pennsylvania Railroad as locomotive engineer, testified:

DIRECT EXAMINATION

I am in the eastern Ohio division, at the present time between Conway and New Galilee, Pa. I entered the service of the Pennsylvania January 4, 1898, as a fireman. I was promoted to engineer July 8, 1902. I have operated as an engineer ever since in freight service only. That includes local freight, through freight, and switching, and some yard service, but very little. I have had experience with all three types of reverse gears. I have had very little experience with the air power reverse. About four or five short trips. All the rest of my experience has been with the hand-bar reverse, with the exception of a few trips occasionally with the screw reverse. Most of my experience has been with the hand-bar reverse. I am operating in local freight service at the present time. I have been on this particular run since December 1930. But previous to that I was still in local freight service but on a different run. I have been in local freight service since 1922. I have much switching to do in local freight service (tes., pp. 3237–3248).

I have never sustained an accident in the operation of the hand-bar reverse and I have never seen an accident due to the hand-bar reverse. The hand-bar reverse quadrant on the engines with
915 which I have had experience is on the right side of the boiler, bolted to the boiler. The foot brace is about the center of the quadrant, perhaps a little forward of the center. The foot brace is bolted to the cab floor. I have never had any particular difficulty in operating the hand lever. It is a little hard sometimes when the engine is just out of the shop, or something like that. That is the only time. It is a little stiff. I have had trouble with dry valves. Our main cause of that has been bad water. I have been able to correct that by using more oil. I cannot recall ever having to secure assistance in operating a hand lever. I cannot recall any trouble in seeing signals due to the operation of the hand-bar lever. I have never been reprimanded or disciplined or had my attention called to missing signals on that account.

I made a count about a month ago, perhaps, or a little less, of how many times I moved the hand bar in reversing the engine or putting it forward in a given time. I counted the times I reversed the engine in fifteen minutes on two different days. The first day I counted, I reversed that engine 21 times in 15 minutes. The day

following, I thought I would make another count, and I reversed that engine that day 15 times in 15 minutes. That is about our usual speed for shifting. As to whether I had some service that required that many operations in the fifteen minutes or whether I was trying to see how many I could make, that was our regular work that we were doing at that time.

CROSS-EXAMINATION

As to how I came to make that test, I just knew that I was coming here and I thought that question might be asked me. That night I took that count we were just doing our ordinary work. We do it practically every night at the same place. You might call that transfer shifting. We were shifting freight from another division to the Pennsylvania division. You might call it transfer. They work about the same on this transfer switching gauged up
916 alongside of other kinds of switching. In this transfer shifting we are always in the clear of the main track, that is, in doing this transfer shifting that I took that count on. At other times we are not always in the clear of the main track, and that makes a little difference sometimes.

(Witness excused.)

JOSEPH COLACHE, employed by the Pennsylvania Railroad in the Camden, N.J., engine house, as hostler, testified:

DIRECT EXAMINATION

I sustained an accident on May 20, 1930. I went in the house to take an engine out and take it down to the coaling station to have it ready to go out, and I went to reverse her, and the Alco power reverse started jumping back and forth, and I heard the knock pretty bad, and I got hold of the reverse lever and held it up in the center to save having a cylinder head knocked off. I held her about two or three minutes. Then the air-brake man went there and opened the auxiliary reservoir. He opened the drain cock and drained the reservoir. Then I felt something happen to my hands, and I pulled off the gloves and I saw a blister. My hand was blistered from holding this lever to keep it from jumping back and forth.

(Witness excused.)

O. E. HENRY, age 57, employed as engineman with the Pennsylvania Railroad, eastern division, testified:

DIRECT EXAMINATION

I entered the service the 7th of April 1901. I was promoted to engineer on the 12th of December 1904. I sustained an accident on March 1925, at Freedom water plug, Conway yard. I was on

the ground when I got hurt, but I was running an engine. That engine was equipped with the Alco air-power reverse gear. That engine was no. 4689, I–1. The weight on drivers was 352,560, I think. I stopped there to take water, and I went to back up,
917 but I couldn't get my reverse lever over far enough to give it enough lead ahead in forward motion. I got down to inspect my valve gear to see what was wrong, the fireman and I, and the fireman was ahead with the torch on the right side and couldn't find anything, and we went around to the left side, and between the lead and lap rod. The radius rod hit me, right there on the head [indicating], on top of the head. The radius rod dropped down where it connected into the link. As to what made it drop down, it went into forward motion. The reverse lever came out of the quadrant, the notches in the quadrant, and dropped down, and she came down on me. The only thing that saved me was the height of my body. It was kind of shoving like that [illustrating]. If I had been a short man, I would not be here today. I did get my skull fractured down there [indicating]. I was off 17 months. A settlement for $10,000 was made with me by the company. I don't think anybody moved the reverse lever in the cab. In fact, I didn't know what had happened until I came to and was up to the doctor's office at Conway yard office, the relief doctor. All I knew is that the radius rod dropped down and hit me. As to what made it drop down, you see, I couldn't get my reverse lever in forward motion far enough, just in the middle of the quadrant, and she let loose and went down. A broken trun'yon pin caused it. The block was locked, and she let loose and went right down on me when I was in under. She hit me right there [indicating]. It cut a hole in my cap and cut hair off of my head, and some red hair stayed on the rod in the grease, and the roundhouse foreman found it at Conway. As to whether the Federal inspectors investigated this accident, I had a talk with one of the Federal inspectors, Mr. Baker.

CROSS-EXAMINATION

They told me what hit me. I was knocked senseless. I was knocked out. I was told a half an hour or such a matter after
918 I came to. As to how many men were in the cab of the locomotive when this happened, the fireman and I were both on the ground and I couldn't say whether the brakeman was in the cab or not. We had a freight train of empties, Sharpsburg to Crestline. The head brakeman was traveling in the cab of the locomotive with me when we stopped, but I think he cut the engine off and we slacked to get away and we backed up. I could back up but couldn't go ahead. He must have been some place around there on the ground. I do not know where he was. You can't keep track of those brakemen all of the time. You wouldn't get nothing done if you did. He could have been any place, so far as I know. I wouldn't say I knew any particular place after he got off to cut the engine

off. He went in and coupled up but that is all I know (tes., pp. 3248–3259).

When I got off the engine I left my operating lever as near in forward motion as I could get it. That is the direction I wanted to go. I had coupled on and put the reverse lever in forward motion as far as I could get it up on top there. She just had enough lead so that when she let loose she went right down in, and she went down, too. The fireman said it sounded like a steel rail piled over on the other rail. I went over on the third track. He pulled me over on the other track to keep me from getting cut all to pieces by a shifter that came down there with a drag of coal. As to how far down I was towards full forward motion, it would be near the center of the link, I judge—that is where the reverse lever would be. The block in the link would be near the center of the link from where the reverse lever is. It was there when I got off the engine. I left it there. I couldn't get it any further forward. They told me what hit me. They found me hurt on the radius rod and the hole in my cap. I didn't come to for a half an hour. They sent a shifter down the yard and took me down to the doctor's office, and he was up there,
and he shaved my head and put some stitches in it. He
919 wanted my head put under an X-ray. They found the cap
of the skull was fractured. The only thing that saved my life was the height of my body. It didn't have much of a drop, and there was more of it shoving and it sent me right out like that [indicating].

(Witness excused.)

C. S. RUFF, aged 46, weight 275, of Sunbury, Pa., employed by the Pennsylvania Railroad as locomotive engineer, testified:

DIRECT EXAMINATION

I entered the service in August 1906 as a fireman. I was promoted sometime in 1913. I can't give you the exact date. I have been an engineer ever since 1913. I had an accident on January 24, 1931, at Duboistown, Pa. I was operating as an engineer at that time on a freight train, class I–1–S engine, 352,000 pounds on drivers. That is equipped with an air-power reverse gear and was at that time. The engine was no. 4491. There were two engines on that train and I was on the lead engine. The train stopped there to take water and cool off a hot on the second engine. When we were ready to start after calling the flag and getting a signal I whistled off and gave the engine steam, but it would not move. I had stopped there with the independent brake and the train was bunched. And thinking it was just in the position the engine set I pulled the reverse lever back in backward motion. I only got a little slack, what was between the tank and the second engine, and I threw the reverse lever ahead, and when I did the engine made a lurch and broke a drawhead off the tank of my engine. As to the cause of the lurch, I opened the

throttle and the cylinders were trapped full of steam. The reverse lever did what I wanted it to do; it did a little more. It took the drawhead out. I threw it ahead and the reverse gear went ahead. As to whether I knew there was steam in the cylinders through the operation of the power reverse gear, I had had the throttle
920 open and the engine moved back all right when I moved back, which, of course, indicated there was steam there. I was able to put the power reverse gear in forward motion in spite of the fact there was steam in the cylinders. I don't believe I could have done that with the hand lever with that class of engine, because there would have been too much back pressure, without opening the cylinder cocks and releasing that pressure. After the drawhead broke there was a delay to our train. We had to get another engine and go down to the next tower, and I had to tow the other engine into Williamsport backwards, as the other engineer was not qualified, and then get another engine and leave both engines at that point. I imagine there was a delay altogether of an hour and a half.

CROSS-EXAMINATION

I had no difficulty in putting the lever ahead. As soon as I put it ahead the engine lurched. The air reverse mechanism operated right quickly. If I had had a hand reverse lever on that engine I would not have opened the cylinder cocks if I could have gotten it ahead. There was nothing to keep me from opening the cylinder cocks in this case, not exactly, except that I did not realize the amount of steam that there was in the cylinders. If I had been operating a hand bar, I would have gotten from it an indication of the steam in the cylinders, because I couldn't have gotten her ahead. It would have blocked me from pushing her ahead. The pusher [pressure] would have been too great. I have been required to push a manual bar ahead on account of trapped steam. That does not always make it impossible to push it ahead. But with the bigger engines it does. It would be impossible with lots of the bigger engines to push ahead. As to what big engines I have had that I was unable to push it ahead on account of trapped steam, I had the H–9's sometimes that would do it. The H–9 is not the largest engine, but it is about the biggest type we have with
921 the hand reverse lever. I mean a hand reverse lever, not a screw. I couldn't tell you exactly what the weight of that engine is. They weigh more than 150,000 pounds on drivers. At times you cannot reverse such an engine with the manual reverse if you trap steam. On some engines maybe you can and others you cannot. If I had as much steam in the cylinders as I had on this occasion it would have stopped me. When you pull your throttle open you have always got the steam in the same fashion. If it gets trapped in there in the right way it will stop it. It always makes it difficult when you get the steam trapped.

(Witness excused.)

G. E. HERT, aged 47, employed by the Pennsylvania Railroad as assistant road foreman of engines, testified:

DIRECT EXAMINATION

I entered the service in 1909 as a fireman. I was promoted to engineer in January 1917. I operated as an engineer from January 1917 to January 1926. I was then promoted to special duty man. I was on special duty about one year. The character of that duty was making observations of locomotives and riding engines. I was promoted to assistant road foreman of engines in April 1928. I am located on the New York division at the present time, with headquarters at New Brunswick, N.J. (tes., pp. 3259–3269).

As an engineer I have operated the hand reverse gear, the screw reverse, manual, and the Alco power reverse. My duties as assistant road foreman of engines are observing the handling of engines and the condition of engines. I spend practically 50 percent of my time riding engines. I operate engines occasionally in riding them as assistant road foreman of engines. I have had experience while assistant road foreman with the various types of reverse gear. In acting as an engineer or assistant road foreman I have never had any accident with any type of power reverse gear. I have
922 never observed any such accident. I have never been physically exhausted or tired out due to the operation of the manual reverse gear.

As a part of my duties I observe the working of the various parts of the locomotive with regard to efficiency and safety. My opinion from my observation and experience as an engineer is that the hand reverse or the screw reverse is more efficiently operated than a power reverse for the reason that when you once have your cut-off set with your hand reverse or the screw reverse it stays permanently until you change it, whereas with the power reverse it does not. If there is any lost motion in the mechanism of the reverse gear your engine will creep to one extent more or less. As to the safety of the respective reverse gear mechanisms, I would say the screw reverse is the safest of the three. As to the practicability or suitability of the various types of reverse gears to the several types of service, passenger, freight, switching, and so forth, for yard and local freight service I would prefer a hand reverse. For road service I would prefer the manual screw reverse. The reason is they are more efficient.

CROSS-EXAMINATION

I was an engineer operating engines from 1917 to 1926, except for about one year that I was back firing during that period. I then went on special duty. I had not been injured in some way that I went on special duty. That was in the nature of a promotion. From 1917 to 1926, I was running in practically pool freight service, shifting service, and all classes of service except passenger service.

I have run extra passengers. The shifting service is yard switching service; what you generally talk about here as switching. I have had very little experience with power reverse in yard service between 1917 and 1926. I have had power reverse in the road service. As to how much, at that time our road power reverse came to us about 1920 when I was running, and it extended to the period when I quit running. We have the Alco power reverse. I
923 have not had any actual experience as an engineer since 1926 with any of the later types of Alco. There has practically been some improvement in the later types than what I got in 1917. I couldn't say whether the improvements on the later types have improved the functioning of the power reverse. I am not in a position to say as to that.

"Q. I thought it was your duty to observe these things?

"A. I did, but I never really had any trouble with the power reverse outside of creeping."

They crept to the extent that when you were running along they would cut the engine down and then they would drop the engine down, and then they would cut back, due to the lost motion. That caused me to work the engine further down than I necessarily would have done if that condition had not existed, because as I found that the engine would cut back I would work her down far enough that she would not cut herself out when she did come back and cause any damage. I never had any damage. I know it would cause damage because it is liable to cause damage. If you shut an engine off and pull an engine out, you are liable to jerk out a draw bar. I have never had that happen.

(Witness excused.)

WILLIAM H. OUTCALT, age 43, employed by the Pennsylvania Railroad as assistant road foreman of engines, testified:

DIRECT EXAMINATION

I am in the Philadelphia Terminal division at the present time. I entered the service August 9, 1906, as fireman on the New York division. I was promoted to engineer December 31, 1915. At the time I was promoted I was transferred to Trenton, N.J., and ran on the extra passenger list and shifting and heavy freight service between Trenton and Philadelphia and Jersey City, and I continued in that service with the regular crew as long as I was able to hold one, with the exception of two summers, when business was slack, I was on the extra freight list in Philadelphia one
924 summer, in shifting service, and the following summer I went to Jersey City in shifting service because of the depression. In 1919 I went into passenger service and ran on the extra passenger list out of Jersey City until 1927. I was an engineer for approximately 12 years (tes., pp. 3269–3279).

I have had a failure once with an air power reverse gear, at Elizabeth, N.J., on the relief to train no. 726 from Point Pleasant, N.J., to Manhattan Transfer, and the supply pipe broke off to the operating reservoir, and as I was entering Elizabeth Station I noticed the main reservoir pressure being depleted, and upon investigation I found the leak and closed the cock leading to the supply pipe. We had only eight cars and we had no detention. The engine was in forward motion and we handled our train to the transfer. I did not have to take any slack. That was a G–5 locomotive, and, fortunately, she started the train without slacking the train. I stopped the air leak in the broken pipe by turning the cock in the supply pipe to the supply reservoir. That happened as we were entering Elizabeth Station, on the main line between New York and Philadelphia.

In my experience in handling hand lever reverse gears I have never had an accident. I have never seen any.

As to what makes an air pipe break off like that, vibration causes it to crystallize sometimes and break. It could be from a strain due to maintenance. It could be put up under a strain or the studes that hold the reverse apparatus to the side of the boiler, if the nuts on those studes would get loose it would set up a vibration which would cause the pipe to break. We have had a number of them to break, and I suppose from a lot of different causes.

CROSS-EXAMINATION

As to how much experience I have had with power reverse, when I went into the passenger service in 1919 it was screw reverse that first year but the next year, in 1920, on the extra passenger list
925 it was about fifty-fifty power reverse and the screw reverse up until 1927, and, of course, all of my experience as assistant road foreman since then has been with power reverse as well as screw reverse.

(Witness excused.)

D. H. JENNESS, age 52, employed by the Pennsylvania Railroad as road foreman of engines, Pittsburgh Division, testified:

DIRECT EXAMINATION

My headquarters are at Pittsburgh. I entered the service of the Pennsylvania Railroad in March 1900 as a fireman. I was promoted to engineer in December 1907. I was an engineman from 1907 until 1922. I had experience as an engineman in yard, local freight and through freight, and some extra passenger service. As an engineman, I have handled hand lever and screw reverse gears. My duties as road foreman of engines are to supervise the operation of the crews and engines. That involves the riding of engines. I operate engines

once or twice a week at the present time. That involves the operation of all three types of reverse gear.

I operating as an engineman or as road foreman or as assistant road foreman I have never had an accident with the hand bar lever. I have never seen one. It is my duty as road foreman to observe the efficiency and general operation of the locomotive. That includes the observation of the reverse gear mechanism. It is my opinion that the hand lever reverse and the screw reverse are the most efficient due to being able to work a finer cut-off on the locomotive. As to whether that applies to yard service as well as to road service, that is road service. In yard service, the bar lever reverse, due to its being quicker than either the screw or the air reverse. It is my opinion that the hand bar and screw reverse are safer than the air reverse for the reasons, first, that in case
926 the cylinders are full of steam the hand bar or screw will tell you immediately when you start to reverse that there is an obstruction there; second, the danger of the air on the locomotive becoming depleted.

CROSS-EXAMINATION

We have yard engines equipped with power reverse. As to whether I judge that the company is putting on an inefficient reverse, I would say for yard service that the hand lever reverse is more efficient than the air operated reverse on account of its being a quicker reverse and the safety feature. It takes about two seconds to reverse an engine with Alco power reverse and about one second to reverse one with the manual reverse. That is the difference in efficiency that I have in mind when I say that they are less efficient in yard service. I said that with steam in the cylinders when you are handling a manual reverse you can feel the obstruction. You may be able to reverse the engine, but it will take considerable strength to do it. I have had engines where I was not able to reverse the engines with the manual reverse because of the steam in the cylinders. That used to happen frequently on the slide valve engines. The size of those engines with slide valves was about 175,000 pounds on drivers. I have never had that experience with a piston valve. I have never had a piston valve that I could not get over. It would make a difference what kind of valves you had if there was steam in the cylinders or in the valve chest in that the slide valve would handle harder than the piston valve.

I think the manual bar lever is safer than the power reverse in that the possibility of having steam in the cylinder in the air reverse and you would not know it by reversing the engine. That would be dangerous. The engine might be reversed and hit cars too hard or hit cars that men might be working on or around. It would not reverse, even with the power reverse, unless the engineer pushed the lever over. As to how it might hit cars too hard, if we re-
927 versed the engine and are awaiting to move up against a coupling and we have the engine reversed and steam in the cylin-

ders it might move away. I have reversed the engine with the power reverse with steam trapped in the cylinder. I have never had anything happen by virtue of that. My air reverse has always responded when I moved the lever.

I don't know whether my company has equipped any locomotives with power reverse that had previously had manual bar reverse on them. There have been engines on my division become obsolete and taken out of service entirely during my time of service. New engines have been brought on to my division after such locomotives had been rendered obsolete and discarded. The discarded engines were manually reversed and the new engines were equipped with power reverse. I cannot answer whether the new engines that are brought on my division are less safe in the reversing mechanism than were the old engines that were discarded. The new engines brought to my division are a different type of engine than we have ever had the bar lever on. It is my opinion that the I–1 engines would be safer to operate if they had manual levers than they are at present.

(Witness excused.)

W. N. JONES, employed by the Chicago & Alton as claim agent, testified in behalf of defendants:

DIRECT EXAMINATION

I am acquainted with a locomotive engineer by the name of Frank Stone, who testified in this proceeding on behalf of the complainant. I had occasion to take a statement from him with reference to an alleged accident on December 8, 1930. That statement was signed by him in my presence. I have that original statement with me.

(The document was offered and received in evidence, marked "Defendants' Exhibit No. 38", Witness Jones.)

The statement itself is in my handwriting. In connection with this same alleged accident, an accident form was filled out
928 by Frank Stone. I have the original of that.

(The document was received in evidence, marked "Defendants' Exhibit No. 39", Witness Jones) (tes., pp. 3279–3293.)

CROSS-EXAMINATION

I do not know who did the typewriting on exhibit no. 39. I did not see it signed. That accident form was obtained from the files of my department. It came through the regular course of the mails to our office. Mr. Stone was supposed to forward it to our office himself. The report is made to the superintendent, the general claim agent, and the claim agent in charge of the territory, and also the superintendent. He makes four copies. This report was in the records of the claim department. The man involved in the accident is supposed to make these reports out himself.

I made that settlement with Mr. Stone. When Mr. Stone signed that document he was handed what was called the voucher. He was handed the voucher by the operator at the same time he signed the release. That accompanied the voucher. The release and the voucher would be prepared after I had recommended the settlement. I received this statement before I recommended the settlement. The whole file went in, together with the recommendation, probably. I did not require a statement from Mr. Stone before I would make the settlement. As to whether that is the practice on our railroad, we do not recommend a settlement until the file is complete, and the file necessary has the statement from the injured party. We get a statement from the party himself. As to whether there is any reason why exhibit no. 38 is not witnessed by somebody, we never have them witnessed. As to whether I always write them in longhand, sometimes in the case of an employee when he is in my office or in some other office, if there is a typewriter handy I use the typewriter; otherwise I write them in longhand. I would not say it is a very perfunctory proceeding. It is an attempt to get the real facts
929 in the case. I have to report them to my superior office, and, of course, I am required to furnish all of the details of the accident. I was in Mexico when I took that statement from Mr. Stone.

It is part of my duties to pass upon claims of this character in Mexico and recommend payment or nonpayment. I am the final word usually. As to whether I wrote my understanding of the actual occurrence when I wrote this statement on exhibit no. 38, I wrote Mr. Stone's statement as to how the accident occurred. That is what he told me. That is practically all he told me. I was in conversation with him and asked him to tell me how it happened, and he detailed it and I wrote it down as he detailed it, and he signed it. It was not on the basis of this statement that I made my recommendation of settlement. It is our practice and custom to pay injured employes, very often when it is their own fault. We often do in the case of an old employee and one who has a good record and all. We don't punish him for his first offense. I cannot tell you of any other case in which we paid $198 or thereabouts to an employee who admits that the injury is his own fault to that extent, except as I say in a general way we do handle all employees' cases as a rule that way. Undoubtedly there are others. I don't recall them just now.

I have been handling them on the Chicago & Alton since 1914. The territory extends from Roodhouse, Ill., to Kansas City, including Kansas City, with a branch line from Mexico to South Cedar City, across the river from Jefferson City. I cannot give you any estimate as to the number of new claims a month we have of injured employees. The accidents have been greatly reduced in the last few years owing to safety work. We do not have anything like 50 a month at the present time. We will not have 25 a month now. We haven't had 20 a month for the last two or three years. In-

cluding slight injuries and not accidents, it might run ten a month or probably a little less than that. I do not recall a case at present that I can refer to of any other employee to whom we have
930 paid approximately $200 when he admitted that he was solely to blame for the injury and the accident.

REDIRECT EXAMINATION

The voucher shows the amount we paid Mr. Stone to be $198 at the time I made the recommendation. I didn't know exactly what it would be. It was based upon half time allowance for the time lost.

(Witness excused.)

GEORGE W. RAY, employed by the Chicago & Alton as assistant master mechanic of the western division, in behalf of defendants, testified.

DIRECT EXAMINATION

I was serving the Chicago & Alton as master mechanic of the western division in December 1930. The roundhouse at Francis, Mo., comes under my jurisdiction. It did at that time. The work reports are filed at that roundhouse under my supervision. I have the original of the work report filed by Frank Stone on December 8, 1930. As to whether that shows that there was any claim of defects to that engine on that day, there were no defects or work reported by Engineer Stone.

(Witness excused) (tes., pp. 3293–3306).

June 25, 1931

B. B. COOKSEY, of El Paso, Tex., age 48, weight 155, employed by the Southern Pacific Lines as a locomotive engineer, on behalf of defendants, testified:

DIRECT EXAMINATION

I went to work for the El Paso and Southwestern Railroad August 3, 1907, and afterwards it was merged with the Southern Pacific. That was as a fireman. I was promoted to run an engine in 1911. I have been in service as an engineer most of the time since that. My seniority is from El Paso, Tex., to Dawson, N.Mex., I guess that would be classed as mountainous territory.
931 It is flat part of the way and mountainous part of the way.

The ruling grade is one percent on the main track. We have some branches with greater grades. We have a 7 percent grade on the switch-back on the branch line from Alamogordo to Cloudroft, and on the Dawson branch it is a 3-percent grade.

The largest types of engines I have handled during my period of running engines since 1911 that were equipped with hand lever are

the consolidation engines. It weighs 196,000 pounds on drivers, and equipped with a Worthington pump 200,000. The next largest engine I have operated with the hand lever is 169,000, a consolidation engine. I have operated all of the different classes of power in service on our railroad from time to time. I have operated in all classes of service. As to what has been my experience in operating the locomotives on my line equipped with hand lever reversing gears as to the amount of physical effort put forth by me in operating them, we only have these two classes of locomotives in service now, and that larger class is in service very little. As to the smaller class, there are 20 of these engines. Two of them are on the mixed run on the Dawson branch and the rest are all used in switching service. I have operated them from time to time right up to the present time. In doing so, I have never become overtired or overtaxed physically in any way. I have had these engines in switching service recently. The 169,000 engines is the regular switch engine used in El Paso, but we use these larger engines when they are short or [of] power, or, I might say, in emergency. I have had occasion to use them in switching service recently. This year I have had several of those engines.

I have had no experience with the hand lever coming unlatched and jumping out itself. As to what has been my experience as to whether or not after I have unlatched the lever at any time it has pulled away from me or gotten beyond my control, of course, the reverse lever pulls but the reverse lever is part of an engineer's business. I don't let a reverse lever pull away from me. I let go
932 of the latch and let it stop. I let go of the latch and let the latch go into the notch on the quadrant. I have not had any experience of letting go of the latch and the lever would go clear down to the corner, or anything of that kind. As to what has been my experience on the locomotives which I have operated for our line as to whether or not I have been cramped or inconvenienced in any way in the cab in operating the engine equipped with the hand lever, I think our cabs have room enough for an engineer. I think these engines are arranged about right in the cab. The reverse lever is handy right here [indicating]. I have not experienced any difficulty with engines equipped with the hand lever in setting the reverse lever wherever we want it.

I have had some experience in operating engines equipped with power reverse gears also. As to how much of the time in recent years I have had power reverse and how much I have had hand levers, it has been practically all power reverse; all but switch engines. I will say I have operated switch engines three months out of the year in the last year. Those engines I have operated as much as three months out of the year were 196,000- to 200,000-pound class and the 160,000-pound class and hand lever. Three of these engines are equipped with the old Ragonett reverse gear. We have some of the same type equipped with the Ragonett and the balance of them equipped with hand reverse. I have operated both.

I have experienced an occasion when an engine equipped with power reverse gear moved in the opposite direction from that indicated by the operating lever in the cab. We had a passenger engine—I think there were ten of them—that came to the El Paso & Southwestern in 1911 or 1912, and they were the old style Ragonett reverse gears. You could reverse the position of the lever without reversing the piston. That is the same reverse gear that we have on these three switchers I was just now telling you about. I was in the union depot at El Paso and attempted to move an engine. That was my first experience. I reversed the lever, but the
933 reversing piston failed to move and reverse the engine and the engine moved in the opposite direction from that in which I intended it to move. As to the result, there was no accident, because I stopped the engine with the air brake. I got stopped pretty close to a derail, however.

In connection with power reverse gears I have observed a movement of the link motion or movement of the power reverse gear while the engine was standing still without anyone operating the operating lever. Upon arriving in El Paso just a short time ago—I think it was last month—the fireman and I were on our way to the wash room and registry room and we came along by a freight engine that had reached the receiving pit before we did. Just as we came by one of these 2–10–2 class engines the link block jumped about four inches in downward motion so suddenly, and it made enough noise, that it attracted our attention. I went back to the cab to see if there was anyone in the cab, because it was unusual for such a thing as that to happen there. I found there was no one in the cab (Tes. pp. 3307–3316).

I have had an occasion during my experience when I was unable to operate the power reverse gear. I had a run-away with a passenger engine on account of the eccentric rod breaking and breaking off the final discharge valve of the compressor, which caused the air to escape, that is, the main reservoir pressure, and it left me without any air to operate the reverse lever. The engine was running light. This occurred at Robsart, N.Mex. It was a one-percent grade at the point where this occurred. I was going down grade. I was intending to take the siding at Robsart for a superior train. It happened to be a sheep train and, of course, I had no air for my brakes, no air for the reverse gear. I made an attempt to operate my reverse gear. I found it locked. When I was about a mile and a half from the switch I began to make arrangements to stop and head in at
934 this siding, and I found I had no air for the brakes, and I tried the reverse lever and it was locked and I couldn't move it. I will say it was locked in half stroke, forward motion. My engine was moving about 33 miles an hour. After I discovered that the power reverse would not operate, I instructed the fireman to see if he could find a hand brake on the tank. Some of our engines have hand brakes on the forward part of the tank and some on the rear part of the tank. I instructed the fireman to see if he could

find a hand brake, and while he was doing this I attempted to turn the steam into the reverse gear—the steam connection. I could not get the steam turned into the reverse gear and the engine was nearing the switch in the siding where I was supposed to take the siding for this train. I could see the headlight of the train at or about the west switch and I knew that I would have to either get off this engine and get it stopped or be on the engine at the time some accident occurred to this other train. There was nothing to stop my engine. My purpose in endeavoring to get the reverse gear to operate was to reverse the engine and stop the engine, or attempt to stop the engine by the power, the steam. By using steam in the cylinders after I reversed it. I said the eccentric rod brake. I think I would have been able to reverse the engine with the eccentric rod broken if I had been able to operate the reverse lever. As to how the rêverse lever would operate the valve with the eccentric rod broken, I don't mean on the disabled side; I mean on the side that was not disabled. I would be able to reverse one side. I was not able to get the engine reversed before I got to this siding. I don't know that I can say I think it would have stripped her on one side if I reversed her on one side without reversing her on the other, but I might say that it might have done it. My purpose in endeavoring to reverse the engine was to use the steam in the cylinders on the side that was not disabled and use that for braking purposes in an endeavor to stop my engine. I was not able to stop my engine
935 on that occasion. I instructed the fireman to jump off, and I did the same thing. As to whether I afterwards observed the engine to see what had taken place, they came out and got me in an automobile and took us down to Emergency Hospital at Carizozo. That is the division point. And we rode by the two engines in the automobile. I saw them as they were standing there head-on.

Referring to the photograph marked "Exhibit No. 40" for identification, this photograph shows what looks exactly to me like the head-on collision that this runaway engine of mine, no. 4386, had with engine no. 3313. The engine on the sheep train was no. 3313. That correctly represents what I saw as I passed by there that day in the automobile. There is no doubt in my mind about this being a photograph of the collision that occurred. The number of my engine was 4386. I say the engine standing on the bridge is mine, the one to the right of the picture. The number on my engine would appear on a plate on the smoke door of the engine, at the door directly in front of the engine. It would be on the headlight, and it would be on the side of the cab directly underneath the engineer and fireman on either side. The number of the engine I ran into was 3313. I recognize the place, the bridge, and the surroundings there; that all looks exactly like it.

(The photograph was received in evidence, marked "Defendants' Exhibit No. 40", Witness Cooksey.)

The point shown in the picture on that line of railroad is about three-quarters of a mile from the point where my fireman and I

got off. This happened near 3 o'clock a.m. Train no. 1 was ahead of my locomotive and on the other side of this sheep train at the time of this accident. That is the Californian. It is a passenger train from Chicago to Los Angeles. It was standing at the depot at Carrizozo, six miles from the place of the accident.

As to why I could not get the steam to working, the time was getting pretty short. I did not have much time, and I found
936 that the main valve of the steam connection was uncocked at the boiler, and the steam and smoke blowing in my face so bad, and I had no light with me, and I had to do this finding by feeling. As to where the steam was coming from, there was more or less steam coming from around the smokestack and dome pump exhaust. This valve was not inside the cab. The steam connection to the air reverse is outside the cab. There was no extension handle that went inside the cab. We have to operate two valves on that engine in order to cut in the steam on the air reverse.

I was two miles or two and a half miles, or something like that, away from this train when the eccentric rod broke. This train was waiting at Robsart and had rights on me. They stayed on the main track, and I was to take the siding with the light engine. Except for a little let up right through this siding, this descending grade is almost a steady one per cent grade down into Carrizozo (tes., pp. 3316–3327).

As to whether or not in switching service or on any other occasion I have at any time used a hand lever for the purpose of retarding the speed or controlling the speed in any way of my locomotive, I don't know that I can recall any special occasions, but I have used the reverse lever to slow down the speed of the engine. I think I was running 33 or 35 miles an hour. As to whether I have ever tried to reverse the engine and stop it going at that rate of speed when I was on one side, I don't think I ever had the experience. The eccentric rod broke on the left side of the engine. I have reason to believe that I could have controlled the speed of that engine on that day if I had had a hand lever to a sufficient extent to have avoided the collision. The reason is I saw these same classes of engines handling trains on one side.

"Q. By Mr. MOREHOUSE: Do you mean down descending grades or on the level?

"A. I have seen this same class of engine handle a passenger train 86 miles on one side."

937 I did not see this engine handling a train 80 odd miles with no air. There was air on the train in that case. There would be nothing I know about the train or the engine except the engine was on one side. They asked me why I thought I could stop the engine. Because this engine is powerful enough to handle the train on one side I had reason to believe I could control the speed and maybe stop the engine by using steam in the cylinders.

As the result of this accident, I received an injury to my shoulder, the right kidney, and a broken big toe. As to the extent the fireman was injured, he was in the hospital with me. He had two scalp wounds and an injury to his left wrist. I lost four months and seven days as a result of my injury. The company paid me $1,200 on account of the injury. My doctor and hospital bills were paid in addition to that. The fireman told me he was off a month as a result of his injury.

We still have the steam connection to the power reverse. The valve is inside the cab now.

CROSS-EXAMINATION

I was about a mile and a half from the east switch at Robsart when I first noticed that I had broken an eccentric rod. I did not make a statement a few minutes ago that I was about two and a half miles from the freight. I said I was about two and a half miles from this train. I didn't know I had broken an eccentric rod until after the accident. I was told the eccentric rod was broken. It could have been broken in the wreck. I made the statement that the eccentric rod broke and knocked the valve off of the main reservoir. Something knocked the valve off of the air pump or the air compressor.

"Q. When?

"A. Since this eccentric rod was broken in two the mechanical men figured that was what broke it off."

As to whether I know that is what happened, I did not see it. That exhausted all of my main reservoir pressure. I am
938 just taking the word of the mechanical people and what they told me as to what happened, that the eccentric rod was broken and put the compressor out of commission. I did not see the eccentric rod knock it. In the event it did knock the valve off of the compressor that would have very little effect upon my engine brakes. If my valve had been lapped at the time my main reservoir pressure escaped or if I had lapped the valve before it did escape, I would have trapped some air in my driver brake cylinders. I would have applied my brakes. I think I would have stopped the engine within two miles. I did not do that. I did not know the air pressure had escaped until I tried to stop. As to when I tried to stop, I don't mean that I exactly tried to stop, but you know I am descending a one percent grade with a light engine, and to use a little air in the driver brake cylinders to keep the engine from going too fast.

I stated that I had known of an occasion where a man had handled a passenger train approximately 80 miles with an engine on one side. As to whether my engine was on one side I don't know whether, technically speaking, this engine was on one side or not. The eccentric blades broke. The valve still had some movement. And maybe you are trying to say that the engine was not on one

side as long as the valve had some movement. I don't know, if the valve has a little movement, whether the engine is on one side. I have run an engine 20 years, since 1911. We would say the engine was on one side, practically speaking. The valve ports on the left side were not blocked. It could have admitted steam to the valve if I had opened the throttle. If I had reversed my engine, I wouldn't have had as much power going ahead as I would going back. Because of the eccentric rod being broken the valve would naturally drift to the center, and all of the valve motion I would have going ahead would be the lap and lead motion. That is problematical.

I don't know when my company moved that steam valve from the outside of the cab to the inside of the cab. All of the engines
939 that I have had charge of of this class have had the valve placed inside of the cab lately.

The date of this was May 2nd, 1929. I endeavored to apply the brakes on my engine at this point about a mile and a half away from the switch. That is how I discovered that I had no air.

(Objection was made to portions of Witness Cooksey's testimony as to the breaking of the eccentric blade on the ground that it was hearsay, and the examiner ruled that the testimony as to what, if anything broke, and what it was that rendered the brakes ineffective should go out) (tes., pp. 3327–3340).

(Witness excused.)

J. C. HARRIS, age 64, of El Paso, Tex., employed by the Texas & New Orleans Railroad as master mechanic, in behalf of defendants, testified:

DIRECT EXAMINATION

The Texas & New Orleans Railroad is a part of the Southern Pacific Lines in Texas and Louisiana. I entered the service of that company in 1883 as roundhouse laborer and later helper to machinists. In 1885 I was put on as a fireman. In 1888 I was promoted to the position of locomotive engineer. In 1912 I was appointed traveling engineer with the title of assistant superintendent. In 1920 I was made general road foreman, and in 1928 I went to El Paso as master mechanic.

As to the extent I have ridden on locomotives, as traveling engineer I was called upon to be on the road almost every day. During that time, naturally, I had to ride locomotives as traveling engineer. As general road foreman I rode the locomotives not quite so regularly as I did when I was traveling engineer, but I would say I would ride probably 18 or 20 locomotives a month. As master mechanic I still ride locomotives. I might say that in the last year or year and a half we have been conducting various tests
940 and for that reason I have had to ride locomotives on my particular division. My division at the present time includes the territory from El Paso to San Antonio, Tex., a distance of 626

miles. We have one branch of 38 miles. My experience as locomotive engineer has extended from Sanderson, Tex., to Houston, Tex. That is a distance of something over 500 miles. As traveling engineer my jurisdiction extended over the same territory. As general road foreman the territory extended all over Louisiana and Texas where the Southern Pacific or T. & N. O. had lines.

When running as an engineer I operated in switch, branch line, freight, and passenger service. As to the types of engines used by me, we started with the eight-wheeler and then the ten-wheeler, the Mogul and Consolidation. As to whether I ran all of the various types that were in service on my territory, I ran up to that type that was the largest power we had at the time I quit running. As to whether I have been familiar with all of the different types of locomotives in use on my road, while acting as general road foreman I was practically on almost all types that we have, even from the small ones to the large. I think I am familiar at the present time with all of the types of power in use on my railroad. As to what extent I have had experience and observation of engines equipped with hand reverse and power reverse gears, as an engineer I handled engines practically altogether with the hand gear. Since I have been in a supervisory capacity I have run some of them and I have been on them and observed the working of them. I have had experience with both power reverse gear and hand lever equipment so far as handling the engine is concerned, since I have been in a supervisory capacity. As to what extent I have run the engines as traveling engineer, sometimes we would have a young runner who would want some instructions, sometimes we would have an old-timer or an old friend who would like to rest a little, and
941 that was probably the extent of my operating locomotives.

I have not been injured in any way in operating a reverse lever and I have not seen any cases of injury. I do not recall any cases where the hand lever became unlatched without action of myself or the person running the engine. I have not had the lever get away from me after being unlatched and I do not recall any case as to others. We do not have many cases of dry valves on my railroad. We have fairly good water conditions all over, and wherever we have dry valves it is a case of probably letting the lubricator get dry or not watching it, or something like that. The hand reverse lever would be a little harder to handle with dry valves. But that is easily overcome. Just ease off your throttle until you are working as small an amount of steam as you can handle it with. That assists the lubrication. As to what has been my experience as to the length of time required to effect sufficient increase in lubrication to overcome the dryness, I would think you can get your lubricator working properly and everything lined up when you are running at a reasonable speed, 10 miles or 15 miles, or say, 20 miles. I handled the reverses all of the time I was operating an engine and I never noticed particularly any great amount of strength required in operating hand reverse. I have never noticed any effect upon me

personally at any time from handling the hand lever. I did not experience any more effort in doing that than I did in doing various other things in my day's work.

We have three types of power operated gear, the Sheedy, the Alco, and the Ragonett. I have had no experience with the Sheedy; I have had experience with the other two. I have not operated power reverse as an engineer. I have handled engines equipped with them since I stopped running. My experience and observation as to the performance of these power reverse gears in operation over the road is that they are not as quick to respond to your movement as the hand gear. My further experience has been that
942 they creep and do not always maintain a fixed point of cut-off. By creeping I mean that the gear will not stay in one position. It goes forward and back and generally both ways. Sometimes in moving the lever to get it another notch it has to be moved more than one notch to get what you want, and then you get too much. I have had that experience. It has been my experience that there is very little difference in the Ragonett and the Alco. It is hard to say to what extent I have observed this creeping in my experience, but it is not so often in riding engines as when it has been reported to me. As to the effect of the creeping, you cannot keep a fixed point of cut-off. I would say the creeping has an effect upon fuel consumption for the reason that I think one of the greatest causes of more fuel consumption than anything else is improperly set valves, and it would be my opinion that any valve that would not stay in position would have something of the same effect. Naturally if it has an effect on fuel it would have an effect on water consumption (tes., pp. 3340–3350).

I have not had any difficulty in maintaining a fixed point of cut-off with the engines equipped with hand reverse. As to whether we have had any cases within my knowledge of breakage with the power reverse, we have had cases where the piston would break in the key-way at the cross head and we have had air pipes break, but I cannot recall any particular case just at the moment. We have made efforts to overcome the creeping of these power reverse gears. When they are reported the maintenance man goes through the gears and tries to overcome the trouble. As to what he does when he goes through the gear, he examines the packing cups, looks into the operating valve, looks into the leaks around the piping, and if there is any lost motion in the pins and bushings in the gear, that naturally has some bearing upon it. I cannot tell you exactly the total parts of the mechanism there are on these types of gear that we use, but I should think there are something over
943 30. As to what the maintenance man has to do in order to examine these gears and go over them, if he goes into the valve naturally he has to remove covers to get in; if he goes into the cylinder he has to take off the head; if it is a question of pins and bushings he has to look over those to see that they are not worn.

As to the result of these efforts with respect to the creeping of the power reverse gears, he may correct the trouble for a while but I have never seen an air gear that would not creep sooner or later after it comes out.

As to the efficiency and economy of locomotive operation of locomotives equipped with power reverse gears as compared with those equipped with hand reverse, I believe the hand gear is more efficient for the reason that it responds quicker and stays put, as we might say, when we handle it, which is not always the case with an air reverse. The hand gear would not creep. As to my opinion from the standpoint of safety as between the power-reversed equipment and the hand-reversed equipment, I would think the hand reverse gear would be safer because there are no air failures of things of that with that type, whereas there would be with the air gear or the power-operated gear.

CROSS-EXAMINATION

The weight on drivers of the largest class of locomotives that I operated as an engineer is 190,000 pounds. That wheel arrangement was 2–8–0. That was a consolidation type. That was when I was running back in the days before I became an official. As to how long I had an engine of that size; these engines came to us in 1904, 1905, and 1906, and along in there, and I left the locomotive in 1912. I did not handle them all of the time, because they were in freight service and I was in passenger service, but they came at a time when we had to use them all in passenger service, so I got them pretty regularly. That was in passenger service. I occasion-
944 ally had passenger runs. As to what speed I ran when handling one of these fellows on the road, the maximum at that time was 50 miles an hour. It was probably around 40 miles an hour. I expect I had occasion to handle the lever at 40 or 50 miles an hour, because naturally you have to hook up an engine or let her down, as the case may be, at speed. With the engine running that fast I would go about hooking her up or letting her down in the ordinary way. That is, with the hand and let her down or pull her back, as the case may be. I have used one hand and I have used two. I think I would use two hands when handling the lever at that speed, because you were running faster and the vibration. I think there is a little more chance of the lever getting away from me at high speed. I don't know that there is so much more pull on the lever at high speed. It is more of a vibration of faster moving parts; vibration all of the way from the lever in the cab to the valve. I think the action of the valves themselves is reflected some in a kind of a pulsating movement on the lever. I have observed when my engine was running at high speed that the lever would tremble and rattle in the latch in some cases; not in all cases.

There is a different movement when you have a dry valve. The engine has a tendency to go a little lame. When it goes lame it is

not a sideways vibration. It has a tendency to go back and forth in the same direction that the quadrant is located. As to whether I have observed that the quadrants on the engines that have been under my jurisdiction have the notches worn in them after they have been out a while, I have seen some worn. I think I have seen the face of the dog worn where it fits against the latch or where it fits against the notch in the quadrant. I have seen it occasionally as an engine gets old. As to whether that happens when they are new and have been out in service a while, I don't remember any cases like that. I couldn't say as to how long it takes before that quadrant will
945 get into that shape. I am a master mechanic.

"Q. How often do you have to take up on and square up the notches in the quadrant on the engines you have?

"A. Since holding that position I have, all our reverses except switch engines."

I do not recall any work reports on the manually operated switch engines we have as respects reversing gear. I suppose we have. I have had 14 switch engines under my jurisdiction, but recently I am cut down to six. As to what I mean by recently, with our location at El Paso the Southern Pacific runs in there, and we run out of there east, and everything works on a 20/80 basis, and they take up 80 percent. I think it was the first of March of this spring that I had it cut down. I had these fourteen engines under my jurisdiction over three years. I do not say that we never had a work report on reversing gears in three years. We may have had them, and I expect we have, but I don't recall any. As to whether I made out any work reports myself from what I had observed on manual reverse when I was traveling engineer or road foreman of engines, I don't remember making out any on that particular case or that particular defect. I never observed whether the engineers with whom I was riding made them out after a trip, for the reason we generally go different ways on arrival at the terminal. I do not recall any personal complaints to me by any engineer about the condition of the latch or the quadrant or the spring of the manual reverse. They may have reported it. I don't recall a trip when the latch or the spring or the notches in the quadrant were not in good shape. I expect it has been three and a half years since I had a trip on the manually reversed engine. Before that time I would say I did probably about an equal amount of riding on manually reversed engines as compared with power reversed engines. As to over how long a period of time that equal experience extended, I was traveling engineer from 1912 to 1920 and general road foreman from 1920 to 1928. I would
946 say that the quadrant, the notches and the spring and the dog were in good condition during that period of time as I observed it. I have not observed the lever working out of the quadrant and slipping down a notch or two in that length of time. I have never observed it while I was on the engines. It has never worked out of the quadrant once in any case that I recall. As to

whether I have ever had the lever slip out of my hands or observed it slip out of the hands of the engineer while he was handling it, I don't remember of any case. I don't think it ever slipped out of my hand (tes., pp. 3350–3361).

I don't remember ever having any locomotive under my jurisdiction ordered out of service by the Bureau of Locomotive Inspection on which there was a defective manual reverse bar reported by the Bureau. There may have been, but I don't remember it. I would not remember that. I have had locomotives under my jurisdiction ordered out of service by the Federal inspector. I don't recall any case where they were ordered out of service on which the reverse gear was mentioned in the order.

I have not handled switch engines that were manually reversed in many years; not except in my early days as an engineer. I said 190,000 pound consolidation engines. That is the weight. I don't think there was any difference in the strength required to handle the lever on those and on the Mogul type or the ten-wheel engines I used to run. I think that is a question of counterbalance spring. The early engines, the Moguls and the ten-wheelers, had slide valves. As to whether in my experience I ever had the slide valve strip break while I was handling the engine, with the old Richardson and Allen valve we used to break a spring, and you would hear a whistle. You would tell that by a sharp whistle. We used to have those. That was in the early days. I operated with a broken spring. That was just a question of a little whistle in the exhaust.

947 That didn't make any difference that I remember. It has been many years since I ran them. I don't remember anything about whether I had any difficulty in handling a slide valve engine manually reversed. It is too far back. I haven't run a slide valve engine in 25 years. The same thing applies to these other manually reversed engines.

"Q. As a matter of fact, it has been so long ago that you do not remember the details of what happened?

"A. Only that I am more familiar with the piston valves than I was in the early days with the slide valves."

In the handling of the 190,000 pounds locomotives I did not have much handling of the lever to do on those trips. I did not run those engines very often as we got them on passenger and it was only when we would catch one on passenger. As to my experience in taking slack at the stations with those engines, I have taken slack a great deal, but I don't think we had to take much slack with those, because they were a large engine with small wheels. I have reversed those engines when there was steam in the cylinders; I think I have reversed all types of engines with steam in the cylinders when they were standing. Naturally, that would make a little difference in the handling of the lever. I don't remember whether I could do that with one hand. I do not recall requiring any considerable effort to throw over any manually reversed bar. It is

so far back I couldn't tell you. I would say that I never did have to use any extraordinary amount of strength to throw over a lever. I will not say that it was never necessary to use both hands in order to throw over the lever. I expect it was necessary on occasions to use both hands. I don't remember, it has been so long ago.

I don't know what other things there would be in the day's work that required as much effort to handle as the manual reverse bar. In local service you have a great many moves to make and you handle your throttle just as regularly as the reverse gear.
948 I have seen some throttles that handled just as hard or harder than the manual reverse bar. It is not my testimony generally. I have seen a throttle that would handle harder than the hardest manual reverse bar I ever handled; I expect I have had some handle fully as hard with those engines, 190,000 pounds on the driver. That was not because the throttle stuck and I could not get it open; I think it was probably in the adjustment of the throttle. I don't recall any cases where I had manual reverse bars where the counter-balance spring was badly adjusted. As to whether there was any other condition on the engine where I had to put forth as much effort as I do in handling the manual reverse bar, I don't [know] anything else about a locomotive that requires any manual labor except the throttle and reverse lever and brake valves. I do not say the operating brake valve would. I say those are the only three things that call for any particular labor. The most manual labor that an engine [engineer] has to perform on an engine equipped with manual reverse in [is] handling the reverse lever.

I said in connection with power reverse that on some occasions I got the hand operated lever one notch and it would take two or three. I think part of that is caused by lost motion in the operating lever and its parts, and I think some is in lost motion in the valve, and it would need repairing. As to whether, if the repairs are made and the lost motion is kept out, you have that experience, it has been my experience that you make repairs and in a trip or two you are back in the same boat. Not with lost motion, but creeping. Several things cause creeping. I don't know altogether what does. The experts from the factory have never told us altogether yet. I think the most trouble—I will admit some will be in the lost motion, but if you take up all of the lost motion and make repairs to your reverse gear and found out in about two trips you are in the same condition, it is not due to lost motion. I think it is due to
949 the packing in the valve, principally in the operating valve. I don't know what I have found in the operating valve after two trips when there was anything the matter with it. If it is cut or anything we take steps to take care of it; we apply new packing and things of that kind. I can't say that I have ever found a valve cut after two trips. As to whether I have ever found the packing cups cut after two trips, I wouldn't say that they would cut that quickly, hardly. As to what it was I found, as I didn't make the

repairs I didn't find it. You see, the repair man did that. This creeping is not due to the working of the link motion on the air piston when you have dry valves; they will creep when you have a perfectly lubricated valve. I would think dry valves first of all put a strain on the reach rod. That strain is communicated right into the air cylinder. As to whether that would cause creeping, it would creep in one direction.

"Q. When it pushes in then there is a tendency of the air reverse valve to admit air in the weak side and bring it back; is there, Mr. Harris?

"A. Well, I would think it would creep in one direction."

I think that does cause some of the creeping. As to whether, if you built up a back pressure in your cylinders, that will throw a strain on the link motion and the reach rod and cause the power reverse to creep, one of the worst times a reverse gear creeps is when you are working the engine hooked back when you do not have much back pressure. It has not been my observation that in working the engine near the corner that you get much creeping. Now, they may do that; I don't know. It is possible to work the engine too close to the center. It is possible that may contribute to creeping.

I said I had not observed creeping so often when I was riding the engine as the engineers reported it. As to what I meant by that, I might be on an engine where there is no complaint
950 of creeping and they report quite often some engine that has her reverse gear creeping. I am not on all of them enough to tell, you see.

"Q. I suppose you have found upon examining those work reports and looking at the power reverse that sometimes you cannot find anything the matter with it?

"A. Well, I don't know. The air man just reports the work as done, and we take the position that it ought to work after he has reported his work done."

I can't say that I have ever found that with the power reverse that it is reported and I cannot find anything wrong with it. I think you can always find something. I said that the air gear creeps sooner or later after it comes out of the shop or after repairs are made. Probably that is true of any mechanical appliance on our locomotive—that it gets out of order sooner or later. I don't say altogether, but I think so. When creeping occurs, it is generally the case that the gear will creep both ways; first it will creep down and then it will creep back where it was. And sometimes it creeps back up closer to center when the cut-off is more toward the corner. I have noticed they practically blank themselves. I have also noticed they cut down to such an extent that you an hear the exhaust several notches. Sometimes the gear creeps one way, making a longer stroke than the cut-off indicates, and in other cases it will creep back and make a shorter cut-off.

"Q. Those two directions of creeping have a tendency to balance themselves, don't they? In one case you burn more coal and in the other case you burn less?

"A. No, sir. They point is they have a tendency to go down and back and down and back. That is the way a bad reverse gear will do. I don't think it would minimize it any" (tes., pp. 3361–3371).

951 I have heard that sometimes they do go back towards center to the extent they will nearly cut out the engine. As to whether in that case they would be using a shorter cut-off and save coal, it is not there long enough to do that. The point is you may be on a hill or somewhere where you are losing power. As to whether it would have a tendency to do that, when it does that naturally it is a softer exhaust. It has been my experience that it does not stay long enough at a place where it varies from the original cut-off. It is my experience that it goes back and it goes back. As to whether the amount of time that the gear is out of the fixed position is really not very considerable until the engineer has a chance to correct it or it comes back itself, it has been my experience that the engineer has very little ability to control that when it once starts. It isn't my experience that a good deal of that creeping occurs when the engineer has dry valves, because you don't have many dry valves. I can't say that I have observed that the engine creeps also when the valves are not set perfectly, because I don't know of any cases where I have been where the valves were not set properly. As to whether I told the Examiner that that was one of the problems we had with our fuel program, I said my reason for making that statement was that one of the great causes of fuel consumption or excessive fuel consumption was due to improperly set valves. If a valve gear is creeping you have pretty much the same effect as an improperly set valve. I cannot say that an improperly set valve causes the engine to creep. I don't think I have ever had, that experience, so I couldn't say. It might do it.

It is my opinion that the manual reverse lever is more efficient and economical in operation. I think that when the power reverse creeps it uses more coal and water. We have no absolute records of excess coal and why that has been used. We have no records of any kind to show that creeping reverse gears was the

952 cause of it. That statement is purely theoretical.

"Q. And your other statement that improperly set valves is wasteful on fuel and water?

"A. That is what I said."

I have two switch engines working at El Paso now. They are regular 0–6–0, what we call the regular six-wheel connected switch engines, superheated type. I forget just exactly the weight on drivers, but I should think they weigh about 130,000 pounds. They are the largest engines I have in switching service, except one, a Decapod engine. I haven't any experience in switching service with

power reverse gears. We have 20 switch engines equipped with power reverse gear on the system. Most of them are the 0–6–0 type, practically the same as this; and then we have some of the new 0–8–0. I don't know what weight they are. They are built since I left Houston. The largest switch engine with power reverse with which I am acquainted is these 0–6–0's. The weight on drivers is the same as the one I mentioned. It is about 130,000 pounds. We have 20 of them with power reverse. They are not in my territory. These engines are located down at Houston. I have no power reverse gear on switch engines in my territory. I have no personal knowledge of the efficiency of the operation of these switch engines with the power reverse mechanism at Houston. The only knowledge that I would have is that they are engines of the same class equipped with power reverse gear as some with hand. And I don't know how they operate because I can't say that I was ever on one of them. I do know that there are 20 equipped with power reverse. We have many more equipped with the hand bar. I said we had 26 switch engines equipped with power reverse gears. They are practically all of one type except the 0–8–0, and there are six of those. That makes the 26. There are 20 of them that are about the same type of engine. When I say "we" I am talking about the T. & N. O. as a whole. Not on my territory.

953 I have no power reverse on switch engines in my territory. We have 20 of the same type that have power reverse, and a great many more have not. We have probably 150 engines of that same type in switching service with the manual bar.

I couldn't say whether or not they can do more switching in a day with the manual reverse bar than with the power reverse. I haven't had the experience. The heaviest engine that I have experience with on my territory with manual reverse is the 190,000-pounds on drivers. That is the heaviest engine we have not equipped with power reverse. The heaviest engine we have with the power reverse gear is 306,000 pounds on the drivers. The lightest engines with the manual bar that I had experience with were eight-wheel engines around 89,000 or 90,000 pounds on drivers. There is no difference that I know of in the amount of physical effort necessary on the part of the engineer to reverse the 90,000-pound engine as compared with reversing the 190,000-pound engine. I would say that it would not require any more effort. As to whether the 190,000-pound engine could be reversed as quickly as the 90,000-pound engine, I think any hand reverse gear engine can be reversed as quickly as another. I don't see why the 306,000-pound engine if equipped with manual lever cannot be reversed just as quickly and just as easily if it is counterbalanced properly. I think it can be counter-balanced so that it can be reversed as easily and with as little effort as the 90,000 pound engine. These 300,000-pound engines are the 2–10–2 type. That does not include the weight of the booster. As to whether I have an opinion as to whether a Mallet engine could be counter-balanced so that the power reverse could be operated as easily as one of these

small 90,000-pound engines, I feel that if everything is counterbalanced properly I do not see why it could not. But as I have never had that experience I am not going to say from what I have had with the 2–10–2 type.

954 As to how many counterbalance springs we have on our locomotive, we generally have a great big coil spring sitting right back of the heavier power and a little elliptic spring on the old power. When the lever is in full forward motion, the counterbalance spring should be in. It is compressed at that time. I would think that exerts pressure until the lever goes into full reverse motion. I have never watched one, but it is my understanding that it does. It does not lift all of the way. I guess it would lift to the center. That is what I would say. I never watched one of them in my life, and I have handled a thousand.

"Q. Would you have to watch it to know?

"A. Well, that is all right. It would go to the center."

As to whether, after your lever is going beyond center into back motion, there is any pressure to be exerted on the lever, I think the weight of the links, if you have Stevenson gear, as it comes over the center would assist you there. I do not mean that the weight of the mechanism would put the lever itself into back motion if you just held the latch up, but there are some conditions—as you pull the link up and when you drop it down it has the same effect as if you were going ahead. That is my understanding of it (tes., pp. 3371–3383). I think there is hardly any difference in the pressure you exert on the manual bar in lifting from full forward motion to center and from center to full reverse. I think it is just a question of going on straight back. That has been my experience in reversing engines. In lifting it from full forward motion to center the engineer is assisted by the counterbalance spring. The assistance is to overcome the weight of the links and the mechanism. With the larger engines that mechanism is heavier and you must have a heavier, more powerful counterbalance spring. I would not say that the link mechanism on a Mallet would be heavier than on any of these other locomotives, because I don't know. I would

955 think so, though. As to why I think that the links would be heavier on a Mallet; I would not say it would be. If you had springs to take care of both sets of links, then that would be my opinion. I don't know whether we have two counterbalance springs on the Mallet. As to whether it would be my thought that the weight of the engine and the size of the engine would make no difference in the physical effort necessary on the part of the engineer to operate the manual reverse bar, I say that is all a question of counterbalance, and I believe that it can be done. That is my opinion.

I said it was my opinion that the manual reverse bar is safer than the power reverse because of the fact that it was not so likely to fail due to air trouble. As to what element of safety there is in that, if your power fails, you have no reverse gear. They are

equipped to turn in the steam if you can get to it. As to whether there is any difficulty in putting the operating valve or control valve where the engineer can get to it, all of our engines are equipped with a steam line coupling into the air line near the reverse gear. The main throttle valve on the boiler head is open at all times. The one on the outside is not. He would have to go outside, of course, to open that. As to whether it must be like that, that second valve is put out there more than anything else on account of steam leaking by. If the valve gets to leaking, if the main throttle valve gets to leaking, you have a double check to keep steam from going into your air pressure. I would not say that second valve is a hazard in the event of an emergency. In the event the engineer wants to turn in his steam to get control of his engine in the event of an air failure, I would not think that second valve, which requires him to go outside to get to it, would be a hazard as long as he can get to it. In the length of time he could get to it he might run into another train. In an emergency the immediate access is the main thing for that emergency system. I do not believe I know of
956 any other element of safety in which the manual is safer than the power reverse.

I have never had the experience of a brake valve ring catching in the port. I don't remember any case where it has happened on our road, but I expect it has happened. I think I would have to have experience to tell whether, in such an event, if I had a manual reverse bar, that condition would have had any effect upon the manual bar. I haven't had it. I expect it would have some effect, but what it is I cannot tell you. I don't know that I would like to express an opinion as to what kind of an effect it would have, as I never had a valve ring break and catch in the port.

REDIRECT EXAMINATION

In the case of an emergency requiring the operation of a reversing gear equipped with the hand lever there is no valve or anything that a man has to move before he can reverse his lever. I mentioned that the steam pipe through which steam is cut into the power reverse gear is connected up somewhere near the power reverse gear cylinder on our engines. It is right close to a T where the air enters to the valve. It is located near the end of the cylinder, which would probably be six or eight inches from the entrance to the valve. From that T-connection either steam or air must move through the same pipe to get into the power reverse mechanism. In the event of any breakage between that T and the power reverse cylinder you would have neither steam nor air to operate your power reverse.

RECROSS-EXAMINATION

You did not understand me to say to Mr. Morehouse that with a manual reverse bar you did not have to move any valve in order

to reverse the engine. I understood his question to be: were there any valves to open or close in the operation of it. I mean there is no air valve or anything like that that I have to move
957 before I reverse my lever. The main engine valve will move with the lever. It goes with it.

REDIRECT EXAMINATION

I made the statement in my testimony to the effect that on the larger engines the link motion would naturally be larger or heavier. I meant that to apply to the Stephenson gear. As to whether that would be the case with the Walscheart type gear, we use very light material in the Walscheart gear, in modern locomotives. As to whether it would be true that with the Walscheart gear, the larger the locomotive the heavier would be the valve motion parts, the valve motion parts on the modern locomotive, with Walscheart gear, are really lighter than with the older type. As to whether, taking two modern locomotives having Walscheart gears, one a Mikado and the other a Santa Fe, the size of the valve gear parts will vary, we have some Mikados, bought back in 1915 to 1918, and we have some 2-10-2 types, built along in 1924, and the valve gear parts to the engines built in 1924 are much lighter and finer material than the Mikados bought further back; both Walscheart gear. As to the relative size of the 2-8-2 and the Mikados, the Mikado will weigh 210,000 pounds on the drivers. The Santa Fe type, 2-10-2, will run from 272,000 to 306,000 pounds.

RECROSS-EXAMINATION

We have not had any late type Mikados. As to the latest Mikado we have got, they came to us between 1915 and 1918, along in there. I would think that the Walscheart gear on a 200,000-pound engine and on a 350,000-pound engine, both of them bought at this time, would weigh approximately the same, because they refine the parts now, and make them much lighter. I would think the motion would weigh the same, even though the engines varied 150,000 pounds on the drivers. The largest engine we have had with the Stephenson valve gear is 190,000 pounds on the drivers. I have not known of engines with the Stephenson link motion on
958 our road weighing more than that. I do not know of any anywhere. As to whether you lift the same portion of the Walscheart motion as you do the Stephenson link motion, when you operate a manual bar, you raise the link of the Stephenson gear, and you raise the block of the Walscheart gear. The block is a much smaller piece of mechanism than the link on any sized locomotive (tes., pp. 3383–3399).

(Witness excused.)

A. J. COSTLEY, of LaFayette, La., age 46, weight 165, employed by the Texas & New Orleans Railroad, testified:

DIRECT EXAMINATION

The Texas & New Orleans is a part of the Southern Pacific Lines. I have been employed on that railroad since 1903. I was a fireman in the first place, for approximately ten years. I was promoted to run an engine in 1913. As to the territory in which I have run engines, the first six years after I was promoted, up until 1919, I worked from Houston to Echo, Tex., known as the Beaumont division. From 1919 to the present time, I have run an engine on the Louisiana western division, or the Echo subdivision, you might call it, of the LaFayette division. That carries me between Louisiana and Echo, Tex. During my experience I have operated with engines equipped with hand levers and other engines equipped with power reverse gear. In the last eight years my time has been divided about fifty-fifty. Prior to the last eight years my experience was mostly all hand lever, except a very small percentage. The largest locomotives on my line that I have operated equipped with hand levers are the C–9 class, 2–8–0, weighing 190,000 pounds on drivers. The largest I have operated equipped with the power reverse is the MK–5 class, 210,000 pounds on drivers. I have operated various other sizes of engines on our lines. I have had experience mostly in freight service.

959 I recall of no instance where I have ever over-exerted myself in handling hand levers on our road. I have had no cases when I had to call anyone to my assistance to help me handle the lever. I have felt no effect upon me physically, in any way, on account of handling the reverse levers. As to what extent I have had experience with operating hand reverse equipment when engine valves are dry, dry valves are something we never have very much trouble with. I have not at any time experienced any difficulty on account of dry valves in connection with the handling of my lever. I have had no trouble with the lever becoming unlatched without action on my part in raising the latch, or without action of the man operating the engine. I never have had a lever get out of my control after I unlatched it. With the hand lever you always manage to maintain the desired point of cut-off with your locomotive. As to my experience with the power gear in that respect, I find that the power reverse gear creeping causes the cut-off to vary. As to what extent I have found that in my experience, I will say 60 or 70 percent, with that class of engine, the engine equipped with that gear. As to what class engine I mean, that is the MK–5's, the mikado class and the M–21 and M–11 and 2–6–0 class. I refer to the Ragonnet power reverse. We had one engine with the Alco. I have run the engine with the Alco reverse gear.

As to what takes place when the creeping occurs, the motion will always let the links down. That causes the engine to work much harder. As to whether it ever creeps back the other way, I never

had much experience with the creeping backward. I have experienced this creeping in main line freight service, 35 miles; I would say fast freight. I have observed the action or movement of the power reverse when the creeping was occurring. I have watched it from the cab window, watched it on the guide bar. You would get the engine hooked up approximately to where you would
960 want it, and watch it closely, and after a while it would move ahead. As to what action I have taken on occasions of that kind, I generally tried to hook the engine up again. I pulled up until I get the slack out of it, and try to hook it up to the notch back where it was, and when it does start to move back, it generally always takes up the slack it went ahead and brings it back twice that far, which makes it come back too far, and it is necessary to put it down again. As to how long it will stay there, after I get it adjusted, it generally stays there until it takes up the slack, until you go to lift it up again yourself. As to whether I am able, after making the adjustment, to hook the engine up at the point of cut-off I desire to have it work when the power reverse is creeping that way, it does not stay there with the maximum throttle. When the creeping is occurring it makes the engine work much harder than necessary. I observe that by the exhaust, by the back pressure gauge, feeling the engine work harder.

"Q. What sort of a feeling do you experience in that way?

"A. If the engine pounds heavier in the boxes."

I have had occasions when the power reverse has set back as far as the center position. That has been frequent. That has been when I have been endeavoring to adjust the lever. The creeping itself was downward, but in endeavoring to adjust the lever, it would come back to center. The matter of locomotive valves becoming dry has been a very infrequent occurrence in my experience.

As to whether on any occasions I have observed the link motion on a locomotive equipped with power-reverse moving, when the locomotive was standing and no movement was made of the operating power reverse lever in the cab, I have noticed the links move with the old style class A Ragonnet gear, but I have never detected that with any of their later gears. I have never had any experience with failure of air in connection with the power reverse.
961 I have never had any occasions when the air-pipe connection to the power reverse became disconnected in any way.

I had a failure of part of my air system connecting with the brakes about three years ago when I had the hand-lever equipment. The threads stripped on the nipple to the discharge-pipe connections to the main reservoir, which immediately stopped the train. That was on the main line. As to what I did to get my train off the main line, I had to back the train up approximately 50 car lengths, put the train on the sidetrack and cut the crossing. I had to make all the movements with the reverse lever. In going ahead, I would move the engine forward, and when it became necessary to stop I

would set it to stop. As to how I used it in stopping, I just reverse the engine in the direction I was going. I did that before I stopped. I did not have the use of my brakes. As to how the lever entered into the stopping, I just reverse the engine in the direction she was going. If I was going ahead and wanted to stop, I would reverse the engine and open the throttle a little, enough to get steam in the cylinders, so that the engine would work against herself. When I say I would reverse the engine, I threw the lever in the reverse motion in which she was going. If I was going ahead, I would back up. By doing that I was able to get my train in on the siding.

(Witness excused.)

E. E. LaPage, of Spooner, Wis., age 59 years, employed by the Chicago, St. Paul, Minneapolis & Omaha in the engine service, testified:

DIRECT EXAMINATION

I have been employed in the engine service since December 1892. I served as a fireman from December 1892 until August 1898. Since that time I have been running an engine practically all of the
962 time. I have operated as an engineer on the northern district, northern division, between Spooner and Duluth, Spooner and Ashland, Spooner and Eau Claire, Spooner and Minneapolis, four divisions all told. That is practically all of the northern Wisconsin territory. My experience has all been in road service, and passenger and freight, helper service. It is all road service, but I have been on helper service. I have operated all classes of locomotives on our division up to the J class. That is a 2–8–2. The largest ones I have operated equipped with hand levers are the 2–8–2, J engines, 227,000 pounds on drivers. I have also operated the class Z engines, weighing 214,000 pounds on the drivers. They are equipped with hand reverse. They were so equipped when I ran them and they are now equipped that way. I have run these same J engines when they were equipped with power-reverse gears. That was between 1918 and 1923 or 1924. During that time that I have mentioned is when they were equipped with hand levers. They had power reverse on them before that. I do not know what type it was. I never handled one of them then. Since 1923 or 1924 the J engines have got the latest Ragonnet-power reverse on them. I have operated with other classes of engines which were equipped with power-reverse gears. I operated a Z engine, a 2–8–0 engine, with a hand reverse, and operated a Z engine, a 2–8–0, with a Ragonnet-power reverse. I have never operated any make of power reverse other than the Ragonnet. We have only the one kind.

In handling the J and Z engines or any other engines with hand levers, I have never felt any effect upon me physically because of the use of the lever. I never over-exerted myself in any way physically in doing so. I never have called anyone to my assistance at any time

to help me handle those engines with a hand lever. I never had the hand lever become unlatched without action on my part or
963 on the part of the man operating the engine. I never had the lever get beyond my control or pull away from me after I unlatched it. I never observed that occur with anyone else when I was riding the engines. I never saw anybody that got hurt with a hand lever or in connection with its use in any way; and I do not know anything about anybody getting hurt. I never was injured with one (tes., pp. 3399–3415).

With an engine equipped with a hand lever you can always place it in a position where you can get the proper cut-off so that the engine will do her work and save fuel. You can maintain that desired point of cut-off with the hand-lever equipment. As to my experience with the power reverse gear equipment in that respect, I had trouble with them creeping. As to what I mean by that, the engine, you hook her up where you think she should run, and she will gradually work down and work back, and then work down, and you cannot hold your lever where it is supposed to be, where you want it. As to how far it would work down and back, I do not know just how far it would move the valve, but I saw the piston in the reversing air cylinder move back and forth about an inch. This creeping would cause the engine to work harder than was necessary. I have noticed an effect upon the movement of the engine or the train. She would surge ahead on the train, like that [indicating], and then come back. It seemed she was always working a little bit more than she was performing. On a hill you would be losing speed under those circumstances. As to what difference I have experienced between an engine equipped with a hand lever and one equipped with a power reverse gear that was creeping in this manner as to what time and attention I gave to the reversing lever, I would have to advance the lever every time that she would start to creep. With a hand lever that would not occur and I would not have to give it any attention.

As to what has been my observation and experience on the locomotives which I have operated on our railroad as to the amount
964 of room about the seatbox in connection with the engineer's operation of his locomotive, there is plenty of room, plenty of clearance, on any engine that I was ever on.

I have never experienced any trouble with the hand lever at all in cold weather. I have had the power reverse freeze up in extreme the course of three weeksclod weather in our locality. That etao cold weather in our locality. That happened four or five times in the course of three weeks. As to a specific occasion, I was kicking a train, a time freight, up a hill for two miles, quite a stiff grade. When I cut-off at the top of the hill, I stopped to pick up the pilot, and he got on the engine and said, "All right, we will go back down the hill." I reached over and grabbed hold of the reverse lever and she was froze solid, and I spent 30 minutes thawing her out on the hill on the main track between stations.

Then I was down behind the depot, standing on the spot track, and had just got the engine out from the roundhouse track, and it was a cold night, and the train was delayed about 40 minutes, and stood waiting for the train to arrive, and it froze up that night. That was about a 25 or 30 minute delay. There is no particualr distinguishing feature with respect to the other occasions I stated that I know of only that I was froze up on the main line between stations. It required about 25 or 30 minutes to thaw out on the other occasions.

I have had occasion to handle locomotives equipped with hand levers around terminals when I had no air and no use of my brakes. As to what I have done in handling those engines, and to what extent I employed the hand lever, I have had them freeze up so that you could not operate the brakes. I came from the yard down to the roundhouse without any brakes because they were froze up so tight they would not operate. The distributing valve from the air reservoir was frozen up. I just throwed the hand lever over on those occasions when I wanted to stop. If I was going over and wanted to stop, I would throw the reverse lever over far enough
965 back so that I would stop down at the place where I wanted to. And when I wanted to go the other way, I would throw it over the other way. As to what effect the throwing of the reverse lever back in the back motion, when I was going forward, would have on my ability to stop, it pumps up pressure in your cylinder. As to the extent I used the stea mwith the throttle, I opened the throttle just enough to admit what steam I needed in there to help to stop. In using the hand lever in that way I was able to control my locomotive and stop it where I desired.

I have never had any experience with dry valves. In our country, we are not bothered with that but very little. As to my experience with so-called foaming water in my territory, we do not have any foaming engines in our territory at all. We have good water, and I have not saw an engine foam in 15 years.

I stated that I had operated these J engines weighing 257,000 pounds on the drivers, when they were equipped with Ragonnet power reverse gears and I have also run the same engine when equipped with hand lever. As to what I can say as to the result of my operation of those same engines equipped with the two different types of reversing gear, I would say that with the hand gear the engine done her work with better performance than she did with a power reverse gear. So far as my own self was concerned, there was no difference at the end of a day's work as to the effect upon me. There was no difference in any other way from my personal standpoint, only that I felt that I had handled the train easier and more economically than I did with power reverse. As to the economy and efficiency of the locomotive operation as between the hand lever and the power reverse equipment, the hand reverse is away ahead, much better than the power reverse, so far as economy goes. As to

my opinion from the standpoint of safety as between the hand lever equipment and the power reverse equipment, in my experience
966 I would say that the hand equipment, the hand lever, is safer than the power reverse lever.

CROSS-EXAMINATION

I say that because I have had the power reverse gear freeze up on me several times in a place where I could not move. I was never injured by it. I have never had any collisions because of that, or anything of that sort. That is not the only reason why I think the power reverse is less safe than the manual. The manual reverse, you have always got it right, and it is ready to go to work, and you can use it at any time you want to. It is always right beside you, right where you can get hold of it. I do not remember ever being in such position on the engine that the manual reverse could have struck me, if it had moved over the quadrant. I have been running an engine since 1898. I will say I have been where the lever could have struck me if it moved back in the quadrant one way or the other. I do not think that would have been a dangerous situation for me if the lever should have moved. I do not know. It would not change my opinion any if I knew that men had their legs broken from the lever coming back and hitting them. If I was crossing over behind the reverse lever, I would not have my foot in the position where the lever would catch it when it went down in the corner and hold it there and strike it. I have never had my foot in that position. I would not put my foot where the lever could hit it. The levers on the engines I have seen operated would not hit it in the corner, if my foot was down there. There is clearance enough so that it could not hit it. There is from four to six inches clearance between the quadrant and any of the pipes on the boiler. I think that is sufficient clearance so that if my foot got across there it would not catch it; if my foot was in there, four inches clearance would not catch it. I have crossed over the back of the quadrant when the lever is ahead. If that lever came back while I was crossing
967 over it would catch me. I never saw one come back. I do not think there would be any danger of the lever coming back. I never saw one come back. If I crossed over in front of it when the lever is pretty well in center and it came down when I was crossing over, I do not know whether that would hurt me. I never seen one come down. I have no opinion as to whether or not it would. I have never seen one come down. I am saying that because I have never seen one come down, never seen one jump out. That is all the reasons that I have why the power reverse is less safe than the hand reverse (tes., pp. 3415–3426).

I have operated the J and Z engines in local freight service. I have had considerable switching to do with them. I have handled that lever when there was steam in the cylinders. It did not operate any harder on those occasions than ordinarily. I do not know that it is

necessary to use two hands to reverse one of the J or Z engines. I sometimes use two hands. I do not know just why. It is a matter of habit. I do not brace myself when I throw over a J or Z lever.

"Q. You do not brace yourself?

"A. I have to hold them in what position I happen to be in and throw them over, reverse them."

The Z engine equipped with manual reverse takes a greater amount of strength to reverse than one equipped with power reverse. I never had any difficulty throwing them over with the power reverse, only when it was froze up, or something else. When the engines are running along over the road, the highest speed we make on one of these freight runs is about 35 or 40 miles an hour. There is no action to the hand operated lever when the engine is going along at that speed. It remains perfectly still in the quadrant; or there may be a little quiver there. As to whether that is a sideways quiver, it is both ways, across and ahead; it is just a quiver. It is just the vibration of that lever, standing up there, that makes it quiver
968 that way. The action of the valves in the steam chest might cause it to shake a little bit. When I unlatched the lever and attempted to move it, I have not felt the pull on it from the valve motion that bothered me any. The lever never pulled out of my hand at high speed. I do not feel any pull one way or the other, either forward or backward. I grab a good hold on it and put her down or hook her up, either way, and it don't bother me any. It does not apparently want to go in either direction when I have hold of it. As to what would happen to the lever if I let go of it, the latch would catch it and it would stop right where I let go of it. I have never had that happen. I know it would catch because when I let go of it for to place my lever at whatever cut-off I want, that is the operation of it. I have never had it slide down a few notches before it catches. I never have had any worn notches in the quadrant. The dog is never worn thin or tapered any where it sets into the notches of the quadrant. The spring in the latch has never gotten too loose. The tension never varied, from being too loose or too tight, one way or the other, on the latch handle. My counterbalance spring has always been in proper adjustment.

On the occasions when my distributing valve froze, if I had had a power reversed engine I could bring the steam in the power revers. In that case I could reverse the engine just the same as with a manual bar. I have never had any experience with dry valves; not to bother.

I said that in my opinion the hand lever is way ahead of the power lever in efficiency. I mean that with a hand lever that it is always right there where you can use it anyway, whenever you want to. It is always in operation. It don't freeze up. That is, so far as I have had any trouble with the power reverse gear freezing up, and that never occurred with a hand reversed engine with me. That is what I had in mind when I said that the hand lever

was ahead in efficiency. The matter which I was considering
969 is the fact that occasionally my power reverse is inoperative on account of freezing up. I do not know whether, when my air reverse freezes up, I can turn in the steam and use it then and it only takes a moment or two to do that. I never had to use steam. I did not ever try it when it was frozen, so that I could thaw it out with steam. We have a steam connection on our power reverse. As to why I did not use the steam connection when the power reverse froze up, the steam pipe outside the cab was frozen solid and bursted, so that I could not use it. I do not know whether the break occurred on my trip or was bursted when I took it out, but I suppose it had bursted before. I did not notice it when I took the engine out. I suppose she was bursted when it froze up. I have had trouble with power reverse creeping.

REDIRECT EXAMINATION

Mr. Stevenson was asking me about trouble with respect to thawing or reversing the engine with the power reverse. That is what I had reference to with respect to the freezing.

This question of creeping enters very much into my opinion as to the economy of operation. As to what bearing it has, you cannot work your engine the way you want to work her. You cannot hold her at a certain cut-off. You hook your engine up with an air reverse, with the cut-off where she does her work, and she commences creeping and works out. She is working harder. The creeping has an effect on fuel consumption. It increases it.

RECROSS-EXAMINATION

I never told anybody that before I came here. I made up my mind about this increased efficiency when I first got those engines and they started to creeping. I made up my mind then that they were using a lot of coal and water. As to whether I said anything to anybody, we talked it over amongst ourselves, the men. It became a kind of habit; became a kind of custom. That is all. I am
970 a member of the B. of L. E. We have never discussed that feature in my division, never when I was there. As to whom I discussed it with among the men, I do not know just who it was, but the men who were operating the engines at the time. I cannot remember with whom. I do not remember when it was or how often it was. As to what I mean by stating it was the custom to discuss that, one man will come and tell you the engine crept on him—just talking—and the other fellow will tell it. That is all there is to it. They will tell you she used a lot of coal on the trip. I do not remember who told that to me. I do not remember whom I told it to. I told Mr. Morehouse; we have talked about it. I do not remember anybody else besides Mr. Morehouse whom I told that to.

I made a statement that my distributor valve froze up and brakes inoperative. As to whether I think hand brakes are more efficient because air brakes freeze up, I do not know anything about that; never had no experience with hand brakes. I was not running before they had air brakes (tes., pp. 3426–3437).

(Witness excused.)

J. F. FLYNN, of Eau Claire, Wis., employed by the Chicago, St. Paul, Minneapolis & Omaha Railroad Company as railroad engineer, testified:

DIRECT EXAMINATION

I was employed as a fireman in 1902. I was promoted to be engineer in 1907. I have been operating as an engineer off and on since that time; set back firing part of the time. I have been running engines about 15 years since 1907, in the east end, Altoona to Adams, Adams and Altoona to Elroy. That is all in the State of Wisconsin. I first began operating engines equipped with power reverse gear about 1916. Prior to that I had operated exclusively with hand-lever equipment. As to how much of my time has been with power reverse and how much with hand levers, say 14 years with air reverse. The Ragonnet and Alco types. We
971 have switch engines with the Lewis type on them. I have not run them. I have run Mikado and J–2 engines equipped with the power reverse; 242 engines. 242 is the size of the Mikado. They weight 227,000 and 239,000. I have had experience in all classes of service, yard, freight and passenger. The 4–6–2 engine, weighing 163,000 pounds on the drivers, is the largest I have operated with the hand lever type equipment.

I never have overexerte dmyself in any way in handling the levers in operating with hand lever equipment. I have not at any time or in any manner experienced any adverse physical effect because of handling the levers. I have never been injured or observed anyone injured by a hand lever or in connection with its use. I have never had any occasion in my experience or observation when the hand lever became unlatched, without being unlatched by the operator of the lever. I do not recall any occasion or experience or observation that after the lever was unlatched by the man operating it, it got away from him or beyond his control. As to what has been my experience with the hand lever equipment as to my ability to maintain a fixed point of cut-off in running over the road, I have no trouble in handling them. Creeping has been my experience in that respect with regard to the power reverse. I mean by that, the lever creeping ahead and back. Creeping with the power reverse is common occurrence. My observation as to the effect of that creeping upon the movement of the engine and the train is jerking with a light train, especially a passenger train, and burning more coal. I have not had any trouble on account of freezing in the power reverse.

In my experience, I have not noticed any difference in my ability to keep a lookout or observe or take signals as between hand lever equipment and power reverse gear equipment, when the power reverse was not creeping; I can handle the engine and keep looking out of the window. That applies alike to both classes,
972 when the power reverse is not creeping. As to what opinion I have from the standpoint of safety of operation as between hand lever equipment and power reverse equipment, the hand lever will stay where you put it. I have never had any trouble with that. It is ready to be used at any time. As to whether that gives me any opinion as between the two classes of equipment from the standpoint of safety, I have never had any trouble except creeping with the other kind.

CROSS-EXAMINATION

I have never been disciplined or called to account for rough handling of trains due to the power reverse creeping.

(Witness excused.)

F. C. Cooper, age 55, of Bellevue, Ohio, employed by the New York, Chicago & St. Louis Railroad, testified:

DIRECT EXAMINATION

I was first employed by that railroad in November 1906, as fireman. I was promoted in November 1911. I have run practically continuously as an engineer since that time, except several slumps, when I was put back to firing at different times. The range of weights on drivers of engines which I have operated equipped with hand reverse gears is 153,100 to 215,730. The range of weights on drivers of locomotives I have operated equipped with power reverse is 220,980 to 238,000. I have had experience with both hand and power reverse gears. I have had experience with the Ragonnet and Precision types of power reverse gears. I first operated a power reverse gear about 1916. Since that time I have operated power reverse gears possibly about fifty-fifty. I have had experience in all classes of service.

I was never injured operating a hand reverse gear. I have never seen anyone injured with a hand reverse gear. It has never been my experience with a hand lever that you could not handle
973 them in a proper manner. I have never over exerted myself in handling them.

I have noticed valve gear parts on a power reverse engine move without anyone moving the lever. My explanation of what caused them to move is difference in air pressure on the opposite side of the piston. I have had experience with power gears creeping. As to whether I have had any unusual experience with the Franklin Precision gear, I have had them freeze up, both kinds. On a yard engine. I could not say how many times. It was a Ragonnet gear.

But with the Franklin Precision I have one occasion in mind. As to what I had to do on those occasions, I had to stir around and get material and thaw the ice out of the cylinders before I could move the valve gear in either direction from where I had been working. I have had the safety latch kick out on a Franklin Precision gear. As to what happened, she screwed herself down in full stroke in the forward motion.

Creeping in a power reverse has a tendency to use more fuel and more water on account of not being able to retain the proper cut-off. As to my experience as to maintaining fixed cut-off with a hand reverse gear, I consider them positive.

CROSS-EXAMINATION

On this occasion when the Franklin Precision froze, the piston froze in the air cylinder, the piston head, rather. I did not try cutting off the air and operating that by hand; but it could not be operated anyway because it was frozen solid. It was hard enough you could not turn it in either direction. I know how hard it was frozen by the amount of condensed water which came out when we built the fire under it. Possibly a half pint of water came out. The water came from the cylinder cock, the main reservoir, in the first instance, no doubt. I said we got possibly a half pint of water. I could not tell, because it was after night. We do not drain
974 the main reservoir before starting out; we have mechanics to do that. I do not know whether they did it; it is their job to see that they are drained before we leave. As to where the water came from which got inside the air piston, it no doubt got in the air pump in the first instance, down through the main reservoir pipe by condensation.

On the occasion when the lever kicked out, there were no broken teeth in the latch or the wheel. That was the G type Precision gear, I believe. I could not tell you what kind of metal the teeth in the quadrant in that particular type were. I suppose cast metal, iron or steel. I am not sure which. There was dirt in the teeth, more or less (tes., pp. 3437–3449).

A. J. RAABE, age 48, of Frankfort, Ind., employed as engineer on the Clover Leaf district of the Nickel Plate, testified:

DIRECT EXAMINATION

I was first employed by the Nickel Plate June 26, 1902, on the coal dock, assistant pit hostler helper. I became a fireman August 23, 1904. I was promoted December 21, 1910. My employment as an engineer has been practically continuous since that time. I was set back to firing for short periods about twice during the first two years. I have had no experience with power reverse gears. All of my experience has been with hand reverse. As to the lightest

engine and the heaviest engine which I have operated in my entire career, we did have some engines which weigh as low as 60,000 pounds, but they have been disposed of, and our lightest ones are now 90,000 pounds, and they run from that on up to 182,640. I have had experience in all classes of service. My present service is through-freight service. As to my experience with the general run of engines as to my ability to handle the hand reverse gear, I have never had any trouble with them, unless once in a while we get one just out of the shop which probably handled hard for a day or so, until we
975 would get them broken in or lubricated, but our engines, as a general rule, handle good.

I have never been injured by a hand reverse gear or seen anyone injured. I have never had a hand lever get away from me while I was handling it. They have become unlatched and gone to the corner. I have had that experience, several years back, when we had bad water conditions, but that has been overcome by the use of chemicals, and we are not troubled over there. I have not had one get away from me for a long time. I have never had a hand reverse lever thrash back and forth over center. I have never found it necessary to call on the fireman to help me reverse the lever. As to my practice as to handling a reverse lever, I sometimes use one and sometimes two hands, just as the notion strikes me. Usually, when I start out, I will reach down and grab it with one hand and pull her up to about half stroke, and after the train gets going, maybe I will use one hand and maybe I will use two.

(Witness excused.)

R. BIERI, age 48, of Tipton, Ind., employed by the Nickel Plate Railroad, Lake Erie district, as engineer, testified:

DIRECT EXAMINATION

I was employed in May 1903 as a laborer in the roundhouse. I became a fireman in February 1904. I was promoted as an engineer in 1910. I remained an engineer from 1910 to the present time, all but two years. From 1919 to 1921 I was road foreman of engines. I have had experience with power reverse gears as well as with hand gears. I first operated a power reverse gear about 1918. As to what proportion of my time I have operated a power reverse and what proportion a hand reverse since that time, in the last 8 years or last 9 years practically all of it has been power reverse. The other four years subsequent to 1918 it was about fifty-fifty. I
976 have had experience in all classes of service. The lightest locomotive I have handled equipped with hand reverse is 106,000 up to 215,000. The range of weight on drivers of engines equipped with power reverse which I have handled is 220,000 to 236,000.

I have never been injured with a hand gear or seen anyone injured. I have never had a hand reverse lever get away from me

while I was handling it. I have had experience with the Ragonnet and Precision power reverse gears. They creep. When a power reverse gear creeps you don't get a proper cut-off, and it has a tendency to burn more coal and use more water. I know that because it increases or decreases your port opening and causes your engine to work harder, and it affects the fuel consumption. The hand reverse gear has been perfect, in my experience, as to maintaining a fixed point of cut-off.

CROSS-EXAMINATION

When you decrease the cut-off, that does not increase the fuel consumption. Decreasing the cut-off does not have any effect on the fuel and water. As to what effect hooking up your engine has upon your cut-off, that will shorten the travel. As to whether the shortening of the travel has any effect upon your fuel and water consumption, it decreases the effect. As to whether power reverse gear creeps both ways and both increases and decreases the cut-off, I never seen one creep backwards that I know of, outside of the distance that it creeps ahead. I am in through freight service. I would say our high speed is 40 or 45 miles an hour. As to how close the operating lever is to the center of the quadrant when traveling at that speed, I imagine about an inch or an inch and a half. That is pretty close to center. I have never had the power reverse creep so that the engine would cut itself out, creep closer to center, when I am running at that speed. I never had it happen to me. It creeps forward and creeps back the distance that it
977 went. I never seen one creep backwards. I have never had any trouble with the engine reversing itself or cutting itself out.

As to how I know there is an increase of fuel consumption by virtue of this creeping, it makes an engine work harder. As to whether I only think that or whether I have seen that there has been more coal consumed, I have not got the figures. I have never made any sort of a check or comparison. I have commented about it to W. N. Baumberger, the road foreman of engines. He is at Lima, Ohio. I cannot give you the date when I told him about this excessive coal consumption. I have no idea. I do not think I told him more than once. I could not tell you exactly how long ago it was I told him. It has not been the past month. Sometime in the last year. I have not told anybody else besides Mr. Baumberger about using so much coal. I have not discussed it with any of the other engineers. I did not mention it to my fireman. I could not tell you who was my fireman on the trip that I used so much coal, because we just do not have creeping gears one trip, but have them several trips. The engine was stoker-fired. I did not mention the increased fuel consumption in my work report. I could not tell you any fireman I had when I observed this increased fuel consumption. I could not tell you the number of any engine or any particular trip. I formed this opinion about increased water

and fuel consumption by virtue of the creeping valve when we first got them. Not before I went out on them. I never mentioned it to anybody until I did to Mr. Baumberger during the last year. I am a member of the engineers' brotherhood. We have about 75 percent of these power reverse equipped engines on my division. I did not mention this fact to any other engineers in my division at any time. It was never discussed in my division. I do not remember mentioning it to any fireman at any time (Tes., pp. 3450–3463).

978 I have observed lost motion in the hand operated reverse gear at various points. Sometimes I have had a weak latch spring. Other times the notches of the quadrant are worn. As to what other parts I have observed which would be worn, when an engine gets pretty well worn, the pin, the reverse lever heel and pin. I mean the pins in the link motion, the blocks and the dog which sets into the quadrant. When all those parts are worn, I have seen the lever working in the quadrant. When your valves are getting dry there is more working than when they are not dry. I do not remember seeing the lever go down a notch or two. I have never seen the dog slip down a notch or two at a time when all those parts are worn that I know of. I have seen the dog rattle when the notches of the quadrant are worn. As to whether there is some variation in the amount of cut-off with a manual reverse, it could be possible, a little bit.

The Precision power reverse-equipped engines operate without creeping on some of our trips. I do not remember whether I have had the same engine that would run over a trip, without creeping, and then run over the same trip where it did creep, with about the same load and about the same weather conditions, the same general conditions. We never have the same engine over any two trips in succession. It is my opinion that it burns more coal when the power reverse creeps. I have got no figures on it. I could not tell you the amount of coal. It is just my own opinion that it does burn more. I do not know whether I ever noticed any difference in the coal pile, when it decreased, and when it did not. I thought about the difference in coal before I discussed this subject with Mr. Thom. I thought about it because I know that an engine with a creeping valve and not the proper cut-off at all times will burn more fuel than one with a fixed cut-off at all times. I know that by past experience running a locomotive. I have not actually observed that situation on an engine.

(Witness excused.)

979 A. W. LIEBER, age 46, of Conneaut, Ohio, employed by the Nickel Plate as fireman, testified:

DIRECT EXAMINATION

I was first employed by the Nickel Plate in 1912 as fireman. I was promoted in the fall of 1917, I think. I would think I have run an

engine altogether about three years. In my capacity as fireman I have been in all kinds of service. In my capacity as engineer I have been in freight, local, and yard work. As an engineer I have had mostly power reverse experience; very little hand.

I have never been injured by a hand reverse. I have been injured by a power reverse about five years ago at this time, is when I think it was, as near as I can recall it. I think the engine was no. 61 yard engine B–11. I had a habit of oiling the engine around when the engine was on the spot. The yard conductor went to the yard office and did not come out, and I said, "I guess I will oil the engine around." I got the oil can out and oiled the right side, where she was spotted, and went over and oiled the left side, and the engine was standing on the left side of the top quarter, and I could not get at the main wedge. So that I walked around the engine, and when I got back to that side again I made up my mind I was going to oil her. The radius rod and link block was at the top, the extreme end of the link, so that I reached over the top valve gear frame and radius rod and got at it that way. While I had my hand in there, the radius rod came down on it. I broke two bones in my hand and one in my arm. I was off duty three months. The company paid me $350. I was at the hospital about three days, I imagine. The company paid the hospital bills and the doctor bills.

I have had some experience with a power reverse creeping when I was running and firing both. I never had one bad enough to have much effect at all on the fire when I am firing. We have
980 got stokers on them engines, and I never noticed a whole lot of effect. You probably have to watch them a little closer. That is about all. I have no opinion as to the relative economy in operation as between hand and power reverse. As to the relative safety as between power and hand reverse, I would think they would be about a fifty-fifty proposition. I could not give any estimate.

CROSS-EXAMINATION

As to whether anybody moved the lever in the cab when the radius rod came down, the radius rod came down, that is all I could say. I do not know whether he moved it or not. All I got was his word for it. I could not see through the engine. The engineer was in the cab when I got off.

(Witness excused.)

J. J. ROSSITER, age 62, of Conneaut, Ohio, employed by the Nickel Plate as road foreman of engines, testified:

DIRECT EXAMINATION

I was first employed by the Nickel Plate on December 5, 1885, as a fireman. I was promoted September 5, 1888. I became road foreman of engines in August 1916 (tes., pp. 3463–3473).

I have operated engines equipped with both power reverse and hand reverse. All the types of power reverse gears that I have had experience with, creep. There is not a power reverse made which does not creep all of the time, a certain amount, but there are times when they creep more than others. A power reverse when first installed creeps a trifle. What I mean by that is that the power reverse is to take the place of the manual reverse, or, in other words, to regulate your cut-off on the quadrant, either with the power reverse or the manual reverse, but the tendency is for it to creep a little all the time. There are times when they become worse and creep a great deal more.

981 I have had an opportunity to test an engine which was creeping, and one which did not creep, with a fuel and water test. That engine was equipped with the latest type of Precision gear on our latest locomotives. That test was made in the week of June 7th, this year. That was on our latest freight locomotive. As to how long the gear had been in service, the engine was only out of the shop. They had only made 18,000 miles, when we made the test, and a new gear was applied at that time, or an overhauled gear. We opened up a nozzle on this engine, from a 7-inch to a 7¼. The reason for this was that the engine is equipped with a siphon, and a feed water heater, and we wanted to ascertain if the engine could be worked with a larger nozzle, less back pressure, on account equipping the engine with the siphon. Before I started I weighed the coal by putting the tank on the scale full of coal and water before we started. Then, when we completed the trip, we filled the tank full of water and weighed it again, and the difference between the tank full of coal and water and just water is the amount of coal that has been consumed over the division. We started out of Conneaut, and the Franklin Precision gear did not creep for about two miles, and then it started creeping, and it crept from there all the way to Buffalo. It is a 114-mile division. The coal consumption on that trip was 23,232 pounds. The amount of water consumed was 161,000 pounds. The train tonnage was 2,998 tons, lacking two tons of being 3,000 tons. The gross time on the road is four hours and 37 minutes over the division, and the total delay is 32 minutes, making a net running time of four hours and five minutes.

I had an occasion two days later to make a test with a Franklin Precision gear that did not creep. We brought the engine right back, took the power reverse gear off, took it over to the back shop where the testing rack is and, as I stated, the gear creeped continually. We put a new piston in that barrel and a new

982 cut packing, tested it out, and it was about as near as you could get it. We put that on the locomotive and I went out with them the next day. It is as if I went out yesterday and the engines were repaired today, and I went out the next morning at 10:20, with the same engine. The same engineer and the same fireman happened to be there on that occasion. There was the same number of cars, ninety. The tonnage we had was 3,032 tons, 34

tons more on this trip than we had on the trip before, which is approximately the same weight. The weather conditions were just the same. The temperature was around 70 degrees, and the wind about six miles an hour. That is obtained from the Weather Bureau, because we make those reports on all our runs, the character of the weather conditions. On that occasion, we were 4 hours and 48 minutes going over the division, gross time, 44 minutes delay, making the net time 4 hours and 4 minutes. We consumed 18,138 pounds of coal and 132,000 pounds of water. We ascertained the coal consumption on the second trip the same way we did on the first trip. We go out to make the actual test, and that is what we are doing. As to what difference that shows in coal consumption of the creeping Franklin Precision gear as against the noncreeping Franklin Precision, it shows in the neighborhood of five thousand pounds of coal, or in the neighborhood between fourteen and fifteen pounds of coal to haul one thousand tons one mile, and that is the way all fuel performances are taken. Those runs were around the 9th or 11th, or the 10th and 12th of this month. I am not accurate just as to the time.

I had occasion to observe that same Franklin Precision at a later date. Like, for example, I will say it was the 10th of the month. We brought the engine back on fast freight that night, known as one of our Kiter westbound manifest trains. We took it out the next day with another engineer and fireman, around 12 o'clock, and the gear worked all right for 74 miles, and it
983 started to jump and creep again. We had to go right through the same routine when we brought her back, took her off again and took her over to the back shop.

As to how the gear acted on this first trip, I said we went about 2 miles and it did not creep. Then it started to creep. That is, she was dropping down and hooking up. Also you could see your reciprocating parts jumping up and down. That continued all the way to Buffalo and all the way back.

CROSS-EXAMINATION

The engine number of this locomotive was no. 665. The type of engine was known as a "Mikado 2–8–2", cylinders 26 by 30 inches, carries 200 pounds of steam, equipped with a superheater, power shakers, feed water heater, and siphons. She is a Duplex stoker-fired engine. The weight on drivers is 236,000 pounds. I noticed the gear on the outside when this Franklin Precision was creeping. As far as your reverse lever in the cab is concerned, that was stationary, but your gear was going up and down. The crosshead to the power reverse was moving. I could not accurately tell you how much it was moving; looking out of a cab going anywhere from 20 to 50 miles an hour, I could not tell, because you are not standing alongside of it. You are looking at it this way [indicating]. I would say it was moving forward and backward, but I could not tell you how far, because I cannot say. I could not

say how fast it was moving. The gears were going that way all the time [indicating]. It might let up once in a while, and not go that fast, but the tendency all the time was to keep dancing back and forth. As to how old the gear was, it was bought new about 2 years ago, but the second gear we put on we calipered the barrel or the cylinder and it was perfectly round, and put in a new piston and new cup packing. As to whether that was just a short travel or whether it was the full travel of the piston when this
984 creeping was occurring, I just got through telling you it was just a little back and forth. It did not go into the corner. Not a fluttering. It was moving back and forth a certain amount. It made the engine exhaust louder. That did not sound like the engine was down in the corner. She was further down than she should have been, but not in the corner. There is no question but that I could see she was not in the corner. The crosshead on the power reverse was moving back and forth, and that affected the exhaust, and that would give your engine a groaning sound. Any engineer knows that. The crosshead was moving enough to cause the valve gear to move. As I told you, you could see the gear going down and coming up. As to how much the block was moving, there is no block. You could see the valve moving. Somewhere from an inch to a fraction of an inch. I would say it was a maximum of an inch. I say that from my having put my head out of the side of the cab and looked at it (tes., pp. 3473–3483).

We took the power reverse down after the trip was completed. As to what we found in the back shop as to its condition, we never asked them what they found. We put it on the test rack, and it did the same thing. As we wanted the engine right away, we put in a new piston and new cup packing. We tested it with air. Placed the air on the power reverse to see if it would remain stationary, wherever you put it, and it would not. It kept creeping back and forth. That is, if you would set the lever at a given point, the gear would still creep forward and backward. The crosshead on your power reverse is the same thing. As to whether it did it of its own accord, without any force being applied to the gear, nobody touched it. That is the way the test was made. We did not find where the leak was. They probably did. We put a new piston and new cup packing in it, and went out with it and made a round trip of 228 miles and 74 miles before they started. We use the Garlock cup
985 packing in the power reverse cylinder. As to whether the Precision manufacturers recommend the Garlock packing, we have had Precision gear men there on other occasions who put this packing in. They recommended the Garlock packing. They recommended the Johns-Manville packing and the Garlock packing, either one. I know they specified Garlock. The representative told they recommended Garlock. I had his name on the end of my tongue a moment ago. The man who comes to our territory is some sort of a name like Skimosh, or some sort of a name. That is not just

his name. It is a peculiar name, Shimo or Skimo, or some name like that. The Nickel Plate is his territory. As to whether we ever tried Johns-Manville packing, we have used both. We have had the same result with the Johns-Manville. I do not know at what point the leak was occurring.

We did not have any difficulty with lubrication on that test trip. As to whether the engine was in good shape in every particular, as I said before she was just out of the back shop, after a general overhauling, and made 18,000 miles. The engineer who ran the train was C. C. Lilly and the fireman was C. Rich. They both live in Conneaut, Ohio.

As to the tonnage of engine no. 665, we have what we call adjusted tonnage. The shorter the train, the more tons. The longer the train, the less tons, due to the resistance. These last trips were about a 78-percent train. Both trains had 90 cars, manifest freight. As to what is the maximum tonnage with 90 cars, you could figure it out. This was a 78-percent train, that is, 90 cars is a 78-percent train. That is 78 percent of maximum tonnage. But we do not put the maximum tonnage on our beef and stock trains because we have to haul them from Chicago to New York in 72 hours, and we are at the mercy of our competitors on arrival at Buffalo, and we have to have them there at a certain time or they leave them.

986 We had 90 cars of beef and stock this time. That is just about what we haul. Sometimes, if we have ample time, we will put on less, and if we are on short time we will cut it down a couple of hundred, but we endeavor to haul 3,000 tons on a manifest train east. I said the weather conditions were the same as before. It is true that any engineer can tell that 90 cars today would not necessarily pull like 90 cars tomorrow. That depends on the weather conditions. It would depend to a great extent on the brake rigging and so forth in some cases, but not on these fast freight trains. We found out in our tests—and I have run hundreds of them in the last 15 years—that on our manifest freight trains we do not vary 500 pounds of coal due to that cause.

As to whether I made a test of whether the draw bar pull on the train taking a good deal more coal was greater than the draw-bar pull on the train which did not consume so much coal, I am running this engine on a back-pressure gage, and the maximum back pressure with us is 8½ pounds. We run them at 6½, and we run them at 5, and you have got certain places on the road where we tell the engineer to proceed with them that way, so that it is operated the same each trip, over the different places on the line. I think the draw-bar pull was approximately the same on both days.

The weight on drivers of this engine is 236,000 pounds. We have forty engines of that same type on that division. We run our engines both ways. All forty are equipped with Precision power reverse. We have had Precision power reverse on those since we got them, and that is in the neighborhood of four years, I think. I would

not be accurate on that, but it is in that neighborhood. I would not say how many tests I have made, of which I have the record, where I undertook to get the difference in coal consumption by virtue of the creeping of a power reverse in four years. I have
987 probably got over fifty tests on these engines. I do not have them with me. The result of those tests is just the same as I told you here. I took this particular test because it just happened. I have not brought any of those tests with me, but we have got all kinds of them on file. I say I have made fifty tests of a similar character to this and the result is practically the same. The amount of creeping on this particular power reverse was not unusual. Compared to other locomotives of this type, it was not excessive. My testimony is that this test I have given you is my general experience on forty locomotives equipped with a Franklin power reverse through a period of four years.

I am asked nothing as to the performance of this equipment as the result of these tests which I have made. It is all indicated to the Superintendent of Motive Power, but he does not consult me as to what he will buy or put on the locomotive. All we do is to give them the results of what we have found. I am not asked for any opinion on the operation of any equipment. They do not ask me and say, "Will you recommend this or recommend that?" They do not ask that of me.

(Witness excused.)

HARRY J. DAMPMAN, age 55, weight 185, employed by the Reading Company, New York division, as locomotive engineer, testified:

DIRECT EXAMINATION

My present service is engineman between Lansdale and Philadelphia. That is express and local, partly express, passenger service. I entered the service of the Reading Company in December 1889. I became a fireman in December 1891. I was promoted to engineer in December 1898. I have been an engineer ever since. As an engineer, I have been in all classes of service, passenger, switching, local freight, and coal run. I have used both the hand-lever reverse gear and the air-power reverse gear. I have operated
988 the Ragonnet and Alco air-power reverse gear. As between the air-power reverse and the hand-bar reverse, I imagine, as near as I can judge, that I have operated 70 percent hand bar and 30 percent power reverse. In the present class of service on my passenger run I operate hand-bar reverse gear entirely. We use class L–5–SC 460, weight 147,550 pounds, and class L–3–SE, weight 139,375, engines (tes., pp. 3483–3494).

I had an accident with a hand-bar reverse lever in this way, the lever broke off just above the quadrant, about two inches above the quadrant, going to Norristown on local service, about 6 miles out of Philadelphia. I took the broken part off and took the train to Nor-

ristown, turned the engine and brought the train back. It was 17 miles from the terminal, 34 miles round-trip. This broke six miles out of Philadelphia, going north. As to how I operated that bar when it was broken off at the top, I used a 12-inch monkey-wrench on top of the lever, and used the larger monkey-wrench, fastened onto the quadrant about half way from the corner. A flaw in the iron caused it to break. I have never seen an accident with a hand-bar reverse lever outside of that particular instance.

As to the clearance in the locomotive cab with regard to the operation of the hand-bar reverse, on the engines we operate we have about 18 to 20 inches clearance between the cab and the quadrant, and we have about a 6- to 8-inch clearance from the boiler to the quadrant. I would say it is 18 inches from the front of the dog, when it is down all the way in the corner. It is the same distance as to the back of the cab. I operate the hand bar with one hand. As to whether that is my general rule, of course, when we get engines from the shop, or an engine which might be laying idle three or four days, until she is lubricated, I might use both hands sometimes.

I have never had any difficulty operating a hand-bar lever. I
989 have never seen fit to ask for any assistance or received any assistance. The bar latch has never jumped out of the quadrant on the hand bar. The hand bar has never got away from me when I was handling it.

I have operated an air power reverse in switching service approximately five years ago. My experience was this: I will give you this, to give you an idea. In the yard service, switching service there, I had engine no. 743, class 1, 2–E, weight 136,675 pounds, and due to a slow-up, they extended my turn from the switching service to the road service. That is what we call a run-about or long road switching. They thought the engine I had would not be heavy enough, and they gave me engine no. 1459, 0–6–0, 169,800 pounds, with power reverse. The other engine I spoke of was a hand-bar engine. I had that engine no. 1459 for almost a year. After operating that engine, I again took a hand-bar engine for the same service. I tried my best to get rid of her time and time again, and finally got my engine back. I tried my best to get rid of her because I did not care for the power reverse. It is very unhandy in switching. As to what I mean by "unhandy", it was a type of an engine, sort of a Pacific type, with the cab in the back, and it was difficult to work, switch, the way I like to switch, fast, with that lever. As to how I operate with a hand bar lever in that switching service, when I am switching ahead, I operate with one hand, and when switching back, I move my seat, which is movable, operating with the opposite hand, sitting in the opposite direction.

I have had trouble with freezing and creeping and delays. I have had trouble—that is, in running and operating on the road, and standing still I have had trouble with the power reverse, with the link block jumping. As to the effect of creeping on the operation

of the locomotive, it is a waste of fuel and very annoying. It causes a bad disposition on the part of the fireman, breaks up the harmony in a cab. You do not have harmony and it is annoying.
990 In the operation of the engine, you use more water. If I dare say it, I would say it is dangerous on fast runs. When I run to New York or Bethlehem, going at a rate of 60 miles an hour, we are continually watching for wayside signals and cross-roads, and your power reverse creeps, and your attention is taken up in the cab. That is why I think it is dangerous. With the hand bar, starting out on the run to New York or Bethlehem, I put my hand bar there, and you do not have to bother with it any more. That is my honest opinion.

CROSS-EXAMINATION

As to whether I have been on this local run for some time, I have run local 50 percent of my time in my career as engineer. In the last ten years, since 1918, I would judge my run was taken off, due to the war conditions, and I switched over into work train service, switching service and passenger service. I run in and out. I have had on the Bethlehem Road since 1918, I would judge, four years through passenger service. That was five years back. I was using the Ragonnet gears then. I have not had any experience with the latest type of Ragonnet. The run which I now have, I would say I run at a maximum speed of 55 miles an hours on my morning run down. The distance I run at that speed is 13 miles.

As to how the hand operated lever acts when running at 50 miles an hour, it just stays there. That is all. As to whether I have observed it chatter and work back and forth in the quadrant, there is no play there. That is taken up by the mechanics in the shop. If there is any there, we report it immediately. As to whether I observed any rattling of the lever when I have dry valves, I do not know anything about dry valves. We report the wear on the pins in the latch to the mechanics. From the constant use of the latch they wear. And, of course, the constant use of the latch in the quadrant will wear them. When that gets to about $\frac{1}{32}$, we report it, and they renew the pins
991 or the latch. As to whether we have lost motion in the bushings and various parts of the valve gear, the link pins, we do not allow that to get to any extent. As soon as it begins, or we feel it becomes a little rattley, we report it.

"Q. Have you had that lost motion to any extent so that you would have to report it?

"A. We do that. We have to. That is the only way to detect it."

When we have that condition of lost motion in the pins of the link block and in the valves and the latch, I have never observed that the lever would work out of the quadrant, slip down a notch or two.

When the engine is new, out of the shop, I say that it requires two hands to handle the lever. I would say that until I start on my trip. I would lubricate the engine much earlier than if I had my regular engine. Probably I would start lubricating a half hour before. Then it might be stiff enough so that I would have to use two hands. That is not after I have lubricated it. As to whether I find the same condition existing when I am handling a lever with steam in the cylinders, when you move a heavy train, you naturally get a lot of steam in your cylinders, and you open your cylinder cocks. I am always able to do that. As to whether there are times when men are on the ground or are standing or I am standing at a street crossing or at some point near the station where I cannot open the cylinder cocks, I would have my fireman look on his side and on my side before doing it. I do not believe I have ever been in a position where I could not open the cylinder cocks. In my switching service I had engine no. 743 for a considerable time. That was the regular engine assigned on that run. I have had regular engines, both in the switching service and in this local service; I have a regularly assigned engine now.

992 I said I thought the power reverse was dangerous. I have had something happen to make me think that. I was down oiling up and the link block started to jump, carrying the radius bar, and I thought then if I happened to be near that point it would cause injury. I was oiling when it started to jump up and down. I would say it jumped a half inch; maybe an inch. As to what I think was dangerous about that, if it would move an inch it might move two inches. If it did move two inches it would be dangerous if it would hit you in the head. I put my head around the radius bar when oiling up. I oil up the springs, saddles, and so forth. It positively is necessary to put your head in the way of the radius bar. If I had a hand lever and I were down there with my head in those parts and somebody moved the manual bar, it would be dangerous to me. It would catch me the same as the power reverse. As to whether that is a good place to keep your head away from, you have to put your head in to oil up. I will say that you could oil up without putting your head where the radius bar will strike you. I might get around and oil up, get underneath to look for cracked frames, wedges, or anything. The radius bar has never hit me. That is not just a ghost that it might hit me. It is my opinion. I think it is dangerous. I saw it jump more than once. I think it is dangerous because I saw it jump a half inch (tes., pp. 3494–3505).

I feel the power reverse is dangerous on account of running over the road creeping. You are running at a high speed, watching wayside signals, road-crossing signals, and at high speed you have to be very careful to pull your reverse lever back. I have never missed a signal or ever struck anything by virtue of that. I have never had anything go wrong by virtue of the creeping and my attention being taken off of it. That is not just another ghost. It is just my opinion, because you are running at a high rate of speed.

I do not belong to either of the brotherhoods. As to whether I ever complained to the company about the dangers of work-
993 ing on a power reverse, we reported those conditions, and we reported it by writing and orally. I could not give you any dates as to when. I thought they were dangerous on account of the jumping and creeping. I did not report to the company that, in my opinion, that was dangerous. I reported the condition. I do not recall ever complaining to the company about it being dangerous. I have never refused to go on a power reverse engine [because] they were so dangerous. I have the seniority to take some of the passenger runs on our New York road, and I would venture to say that I could get twice as much money, and that is why I stay away from them. I do not like them because they are dangerous. I do not think I told the company they were dangerous. I accept one-half the wages that I might earn not only on account of the danger, but the conditions. I cannot have harmony with my fireman, or anything like that. I am earning $8 on my present run. I could take the New York run, which would pay me $14 a day. I could not work every day on that. I work 26 days on my present job. I could work 26 days on the other job if I am not mistaken. I may be wrong on that. They get a relief today. I do not know just the number of days they do work now. They get relief days, and how many days they get, I do not know, but I know they make more money than I do. In a full month, the most I could earn on my present job is $208. I might have stretched what I could get on the other job a little. They average over $300. I have never notified the company that I refused to take a power-reverse engine because it was dangerous. I have reported power reverse creeping, jumping, to the foreman at 9th and Green Streets, Philadelphia. That is merely my daily work report. I have never made any special report about the dangers of power reverse.

This hand lever which broke, that was my regular engine. It broke about two inches above the quadrant, right where the latch bolt goes through which holds the spring to carry the latch.
994 I was starting out of 22nd Street, and just pulling her up when it let go. I had hold of it. I had used the lever before that day. I was hold of it just as I demonstrated with my left hand. I opened the throttle and was in the act of pulling her up in this manner [indicating] when I felt just like this, giving away [indicating], and it pulled off and stood in the corner. There was no pull on it. There is no difference whatever in the amount of pull on the lever when it is way down in the front corner and when it is near the center. As to whether there is under any conditions or circumstances, as I mentioned if it happened to be full of steam and you tried to move the train, and the brakes were on there, or something like that. There are different conditions. But under ordinary conditions, it is just the same. When I go out at night on my run, I push the latch and it comes back like this [indicating]. The

spring is so adjusted. The spring would not lift the lever from full forward motion to the center without pull, but the tension is adjusted in such a manner that it requires very little pull. You guide it like this [indicating]. It all depends as to whether I pull it at all. If I am pulling out of a heavy grade, I might pull it. As to what difference the grade would make on your hand lever, you are using a heavier throttle. That makes more steam on the end of your valves and more steam in your cylinders. We have inside and outside admission. They are piston valves (tes., pp. 3505–3514).

(Witness excused.)

EDWARD WHETSTONE, age 49, weight 155, employed by the Reading Company as locomotive engineer on the Shamokin Division, testified:

DIRECT EXAMINATION

I entered the service of the Reading Company in 1902 as a brakeman. I was made a fireman in 1907; promoted to engineer in 1917. I have acted as an engineer in all classes of service,
995 freight, passenger, and switching. I have used the Ragonnet and Alco types of power reverse and the hand-bar reverse. I am on the extra board at the present time. I work from 15 to 22 days a month. That is uncertain. I operate between Tamaqua and Williamsport or Newberry junction. That is mountainous country. That runs about fifty-fifty between freight and passenger service.

I have never had an accident with a hand-bar lever or seen one. We have ample clearance on the locomotives on which I am operating with a hand reverse. There is about 18 inches between the side of my cab and the reverse lever; about five to si xinches between the quadrant and the boiler. There are 14 to 18 inches at both ends. I have never had any experience with the hand-bar latch jumping out of the quadrant notch. I have never had the hand bar jump out of my hand when I was operating the bar. I have never had assistance in operating a hand bar, unless it might be that we have an engine that is just out of the shop or one that lays around the ship for a few days. That requires assistance sometimes. A new engine, as a general thing, works a little stiff on account of new bearings.

I have had trouble in operating the air power reverse gear. In January of this year, I had class G engine no. 200, while going up Locust Summit, we have to work the engine at full stroke, when we get within one mile of the top of the hill. I had been forewarned by the fireman that this engine had tied up on different occasions. When we slowed down to probably five miles an hour, I reached over and held my power-reverse lever, and I found a big pressure against it. I reached up with my foot and placed it against the back end of the reach rod and held the valve at full stroke. I made the hill. He told me that he did not know of ever having slowed

down that low before. He told me, and I suppose his informing me about it helped me. They have been making that by
996 holding with their foot. I did that account of the creeping back. We have to have every bit of energy in that engine to make the last mile. If I had not held the lever in that position, the engine would have lost power due to the fact that the valve would have cut back, and she would not have had the pressure that she had at full stroke. When we tie up there, it is necessary to go to the closest phone. We are not permitted then any more to make any switching, on account of tearing the train, or something may happen. They send an engine from the bottom of the hill to meet us, to assist us, or one from the top of the hill, Locust Summit, whichever is the closest. This happened in January. Before we got there he told me about it. I probably would have stalled too, if he had not notified me. They had been stalling right along up to that time.

I have been troubled with freezing of the air-power reverse. At the beginning of this year, in cold weather, I pushed train no. 57 north of Buck Mountain. At Buck Mountain there is a tunnel about three-quarters of a mile long, which we have got to go through, and on the other side we return to Tamaqua. After I got midway between Buck Mountain and Tamaqua, there is a place where they take coal and water, and I had taken water and had about 8 minutes before no. 14, the Williamsport Express from Williamsport came. I instructed the fireman that we would have to get on a siding on account of not having enough time to get to Tamaqua. After I backed back to go into the switch, I tried to reverse my engine, and it was an impossibility. I was froze up. In order to clear train no. 14, I had to return to Tamaqua. The engine had been in reverse and had frozen, and I had to make those other five miles with it frozen up. I have never had any trouble with weather conditions and with freezing in connection with a hand-reverse bar. For my own personal safety, I consider the hand bar safer than the power
997 reverse due to the fact that the hand bar is between the side of my body and the boiler. With the power reverse, it is directly in front of me. It is possible that the thumb-latch bolt on the power reverse may work out, unbeknown to you. If the reverse goes back, while using my sand leaches or my bell-ringer, or starting my water to flow, to prime an injector, or pulling out the rail rod of the injector, the priming rod, I am directly in front of it. I dare say by pulling on my injector, or starting my valve, my head is right under the lever, if it came over, and would hit you square on the head.

CROSS-EXAMINATION

As to whether I have ever been in the engine cab in such position that if the hand-operated lever were to come back it would have hit me, I guard against everything where there is a possible chance of getting hurt. I guard against that because everything is possible.

It is possible for the manual lever to come back and hit me. I have never seen it, but it is possible. I have never seen the power lever come back and hit me. As to whether the leverage of that long Johnson bar would have more force than the small hand lever of the power reverse, that is the reason that I never step in front of it.

At times the power reverse lever operates fast. As to how fast I have seen it go, I have seen it where it would jerk my arm right down in the corner with it. As to whether in those cases I was having dry valves or trouble of that sort, on the division where I work we don't know what dry valves are, due to the fact that we are permitted to carry an extra kind of valve oil, and when we go to work, we are given a full lubricator. That extra pan is given to us by our road foreman of engines in case of shortage of oil anywhere along the road. So that we have no occasion for dry valves. My engine never works water, outside of coming out of the house and shop, and filling it up. Somebody else has had dry valves out
998 of the shop, not me. I have had a leaky pipe. Whether that washes the lubrication off of your valve depends on the condition of the engine and on your motion. I have had them leak, but I have always carried the water so low that it would not affect the engine a great deal.

I have never had anything wrong with the manually operated reverse to my knowledge. We do find times that there are parts worn, but we are instructed and have forms and when we get at the end of the run we make a report. Before I get to the end of the run, I have observed the lever working in the quadrant. I cannot say that I have had experience with link blocks being too tight. As to whether I have ever handled one of those Johnson bars when I had steam in the cylinders and could not get rid of it, I do not understand what you mean when you say you cannot get rid of it. We have release cylinder cocks on those engines, which we can open up and they will release the pressure. I am always able to open the cylinder cocks. I have never been in such a position that I could not open the cylinder cocks. On our division we are out in the woods, and can open them at any time we feel like it. I have reversed engines with steam in the cylinders. As to whether I find the lever works harder under those circumstances, as I told you before, when I get the lever and it works hard, I take hold of it and open the cocks. I have never had it so that I could not open the cylinder cocks. The cocks have always been under my control. If you have a leaky dry pipe, under conditions you cannot carry the water low enough not to get some of it in your cylinders. As to whether I have had those conditions, on the local freight where you do a lot of switching, where the water surges in your boiler when handling your train rough, it will, but that is not excessive and that is the reason the valves don't get dry. It is just a surging and it is all over. I have never felt the effect of that in handling the lever (tes., pp. 3514-3525).

As to whether it is ever necessary for me to take two hands in order to throw over the manual lever, I have made the practice
999 since I have been an engineer to use both hands, with both reverses. As to why I do it with the Johnson bar, I suppose it is just a practice, as I told you, because of conditions in switching. With the Johnson bar on some of our engines class I–8, we, as a general thing, are in a standing position, standing up. Sometimes I reach down with one hand and get hold of it, and if I am working ahead, I might hold it and throw her back. It is a matter of practice and not that I could not do it with one hand. There is not enough difference in handling a manual lever in cold weather that I notice it. They handle just about the same in the winter and in the summer. I do not brace myself when I handle the lever going over the road. I keep my foot and my body as far away from the reverse lever as I can. As to where I put my feet when handling the lever over the road, when going over the road it is not necessary to handle the lever. As to how many times I hook up an engine after I start out of a station, that depends. It would be an impossibility for any man, I think, to answer that question as you have asked it, due to the fact that we haul different trains, of different weights. A heavy train takes a long time, and it takes a long time to get them back. A light train, you can do it quicker. As to how I handle the lever with a heavy train going out of the station and over the road, while starting from a station I work my engine at full stroke until I get up to about 10 miles an hour. I reach down and pull her back 4 or 5 notches, and from there on I will sneak her back one until I get her to a cut-off which suits my desire. I never let go of her after I hook her up about the second time. I hold on to the lever and bring her back notch by notch. I do that in order to help the fireman maintain steam pressure and save fire. I have never felt any pull on that lever when bringing her back notch by notch; our engines are equal-
ized. We have to use some little power in pulling back the
1000 engine toward center of the cut-off. I do not think there would be a pull against me when I am bringing it back. It would be more of a lift, as if you were lifting something. There is no pull against you. That does not vary with the speed of your train enough to take notice of. There are times that I will put my right foot against the cab window while I am performing that operation of hooking her back a notch at a time. That is about that high from the floor when you sit up [indicating]. I brace one foot against the cab window and my other foot will be on the floor, away from the reverse lever. As to how far from the quadrant my foot would be, it is about 10 inches of space in there, and, as a general thing, we sit with our foot pretty near the center of the floor. The window is about 20 inches from the quadrant. As to why I keep my foot on the floor away from the quadrant, I suppose it is a practice, or it might be more handy to have my foot kept there.

I belong to the B. of L. E., no. 652. On this occasion when the lever of the power reverse was being held with my foot, the engine was working at full capacity. I dare say I was not going above four or five miles an hour; five miles at the highest. As to whether the power reverse had operated all right until I went up that hill, I had not taken notice much of it up until that time. I do not believe that I could say what caused that lever to come back. I examined all the connections from the reverse lever to the valve cross-head, and everything looked to be very good. I had reported the packing, and the packing was examined at Newberry on account of reverse creeping. I never made any inquiry as to whether the defect was in the packing. I made the report, but I do not know.

(Witness excused.)

THOMAS HORAN, age 47, weight 194½, employed by the Reading Company as engineer on the Reading division, testified:

1001 DIRECT EXAMINATION

I entered the service of the Reading in July 1906. I was made a fireman November 24, 1906. I was promoted to engineer on January 24, 1917. I have acted as an engineer in all classes of service. I have used the Ragonnet and Alco air-power reverse and the hand lever reverse gears. My present occupation is extra engineer. I handle different kinds of engines, different kinds of reverse gears, in that service.

I have never had any accident with a hand bar reverse gear or seen one. I have never had any trouble with operating a hand bar reverse lever. I have never called for assistance. Most of the time I operate the hand bar reverse with two hands. I have never been physically exhausted or tired at the end of the day in handling a hand reverse. I have always felt better at the end of the day after handling a hand reverse than an air reverse. I attributed it to the fact that I got more exercise; I could move around better, and I could change my position more frequently, and I had better air in the cab. Our cabs with the hand reverse are in the middle of the boiler. The cab is situated in the middle of the boiler on our hand-power reverse. In the summer time I can open the front door or open the back door or open both, and I get the air both ways; whereas with the power reverse you only get the air one way. That is because of a different type of engine. The gear has nothing to do with that.

We have plenty of clearance in our cabs, in the cabs I have been on, with reference to the hand-bar reverse. I have never seen or had a hand-bar latch jump out of the quadrant. I have never had the hand bar jump out of my hand when using it.

I have had trouble with the air-power reverse. The power reverse froze up on me one morning, as I was going north with a mixed train, hauling coal cars and freight cars. After I had gone about

22 miles, and I was making my first stop in order to
1002 pick up or set off—I do not just recall which it was—when I went to operate the power reverse, I found I could not reverse the engine. So that I had to get down with fire and thaw out the slide valves and the exhaust pipe, which consumed about ten minutes at that point. I went about nine miles further, and I had more work to do, and I had the same experience and consumed about the same amount of time there. I have never had any trouble with a hand lever due to weather conditions.

I have had experience with the air-power reverse creeping. You cannot obtain the desired cut-off, and it makes it very inconvenient, and makes it harder on the coal and the water. When I was operating as a fireman, I observed difficulty with the air-power reverse. In 1915, I was firing for one of the most particular men on the Reading division, or that I know of. While I was preparing my fire—we fired hard coal those days, sometimes egg coal and sometimes steamboat—and he was a very particular man, and his engine had to be spotted just so before he would get down to start to oil. This day he must have forgotten himself, and while I was shoveling coal in there, he got up on the engine and went to move her two feet, or whatever length he wanted to move her. I do not know just what. He gave her steam, anyhow, and must have forgot he did not have the air pump running. He had no air, and no way to stop. The engine was within a distance of 20 or 30 feet from the turntable pit, but the young man who was operating the turntable pit at that time happened to see the engine coming slowly toward the pit. He tried his best to get the table set rail for rail, but he missed a little bit. But my engineer unloaded. Of course, he could not see what the other fellow was doing, this turntable man, but I had a better view from the left side, and I watched to see that he got the table set or pretty near set, and opened the pump throttle. When
I say the engineer "unloaded" I mean he got off. I saw the
1003 engineer handle the reverse lever. Just as soon as the engine started to move, I wondered about it, and looked up and seen him pull her back, but there was nothing there to help him out. I could see the turn-table man swing the track around and that is the reason I did not jump (tes., pp. 3525–3535).

I have seen evidence of creeping while the engine is standing still. Last Saturday, I ran an Alco, and it is a very frequent occurrence. In fact, it happens so frequently that I do not pay any attention to it any more. Last Saturday I was running engine no. 201, and when I got down to oil, the engine or the block moved in the link, like that [indicating].

As between the air-power reverse and the hand-bar reverse, in my opinion and in my experience the hand-bar reverse has been the safest. For instance, in emergency, when I move with the hand reverse, it always has responded. With the power reverse, it would not be as liable to respond. I had it fail to respond in the instance

where I froze up. I do not recall any other instance at the present time.

CROSS-EXAMINATION

I am a member of division 90, B. of L. E. I have never been injured in any way operating power reverse.

(Witness excused.)

JOHN TROUTMAN, age 54, weight 193, employed by the Reading Company as locomotive engineer on the Wilmington and Columbia division, testified:

DIRECT EXAMINATION

I entered the service of the Reading Company January 5, 1910. That is the last time I entered the service. I had a year and nine months once before on the Reading, and about one year on the Pennsylvania. I was promoted to engineer on the Reading,
1004 March 30th, 1914. I have been acting as an engineer practically ever since, except one year during a depression I was put back to firing. I have operated all classes of service. I have used the Alco and Ragonnet A air-power reverse gear and the hand reverse. Since about the first of the year, the proportion between the air-power reverse and the hand reverse which I have operated is about 80 on the hand reverse and 20 on power. I have been in passenger service for the last three weeks between Lancaster and Reading. Prior to those three weeks I was engaged in freight service between the same points.

I have never had an accident or seen one in operating a hand-bar lever. I have never had any trouble in handling a hand-bar lever. I have never seen the latch jump out of the quadrant. I have never had it get down in the corner. I have never had the hand bar jump out of my hand when I was using it. I think I had to call for assistance one time in handling the hand bar. We had an engine out of the shop that I could not get out of the corner, but after we got her loose from the corner I could handle her all right. That was before I started on my run.

The only trouble I had with the air power-reverse gear was that it froze up with me. That was at Apherta, Pa. We placed a car of coal up on a dump there, and the next engine we had would not go on the dump, and we had to have a car to place this car. After we had spotted the car and went to move ahead, the reverse lever would not respond, so that I had to get out and thaw it out, and then by doing that I had a delay there of about 10 or 15 minutes, blocking the highway crossing. As to whether I heard any honking of automobile horns, there were quite a few around there. I have seen them creep quite frequently. As to what happens when the engine creeps, in my opinion she works against herself when she creeps back, and when she creeps ahead she works more free.

1005 CROSS-EXAMINATION

In my opinion, I would rather have a hand-reverse than a power reverse.

REDIRECT EXAMINATION

As to why, when you put her there, she is there, and when you use a power reverse, you do not know whether you have got it or not, when you go to handle it.

(Witness excused.)

CHARLES E. BEECHER, of Harrisburg, Pa., age 43, weight 170, employed by the Reading Company as locomotive engineer on the Harrisburg division, testified:

DIRECT EXAMINATION

I entered the service of the Reading June 25, 1911, as a fireman. I was promoted to an engineer January 25, 1917. I have served as an engineer in passenger and local service. I have operated the Ragonnet and Alco air-power reverse and hand-bar reverse. Last week I was set back to firing. Prior to that I had been on the extra board. As to whether I had worked frequently during the month on the extra board, during this depression we were down to about 15 or 20 days a month. It varied. In that service, I operated in all classes of service. You never knowed what it was going to be when you were called.

I have never had an accident with a hand-bar reverse or seen one. As to whether I ever had any difficulty in operating the hand-bar reverse, when she comes out of the shop, naturally she is a little tight and a little stiff, and it takes a little effort to reverse them, but you would not call it any trouble, reversing the engine. I never had to call for any assistance. It just depends on what position I am in in the cab whether I use two hands or one hand. As to
1006 the clearance of the hand-bar reverse in the cabs, there is 14 to 18 inches space on those engines between the bar and the side of the cab, which gives you plenty of room. I guess the clearance between the boiler and the bar is five inches. You have in the neighborhood of 18 inches front or back, about the same. I have never had a hand bar jump out of the quadrant or the hand bar jump out of my hand when using it.

I have had the air power reverse gear freeze and creep some, once in a while. About three years ago on Richmond Hill, I wanted to put it a couple of notches farther down, and found I was frozen up, and we were finally stalled there and I had to get out and thaw it open. There was about 15 minutes detail [delay].

Creeping with the air power reverse gear is a frequent occurrence, and on several occasions, why, I noticed that the engine creeped or the reverse would creep while she was standing still. The link block

would move when she was standing still. In my opinion, I believe the hand bar is the safest. There are less parts to get out of order, and if you set it at a position, you are positive it is going to be there (tes., pp. 3535–3545).

CROSS-EXAMINATION

I have never been struck with the operating lever of the power reverse. It always remains stationary in the quadrant, even when the engine is creeping. I never had any air reverse jump out on me.

I have had engines which are equipped with power reverse and manual reverse when they are new, out of the shop. As to which class of engines takes the most strength to handle the lever, the manual reversed will take more effort than the air reversed, although I have had several engines which I can recall, when the air reverse was clear back, you know, and you do not get it so much coming from the forward motion to the center position as you do in back, where I would prop my arm against my hip and give it a start.

1007 All you have to do with the power reverse is to start the valve and the air takes care of the rest. That is the principle of the air reverse, as I understand it. I have had manually reversed engines handle harder than that when there is steam in the cylinders. As to whether, when the lubrication is bad, I find that the manually reversed engines require more strength than the power reverse, I never had any trouble with lubrication on our road up there. We generally get plenty of oil. I do not recall any occasion when my valves were getting dry.

I have had occasions when the counterbalance spring on the hand lever has been out of adjustment. As to whether, under those circumstances, the hand lever will handle harder than power reverse, it is only a matter of two or three minutes and a man can get down and adjust it himself, which I have often done. As to whether I know it is out of adjustment until I have had it put the extra pull, I generally have figured that out before leaving the roundhouse, that is, how the bar works. I remember I had one in the house assigned to me, and I took hold of her and threw her back, and I went back through the back windows. They did not have the links ready on her. It did not hurt me any when I went through the window. You cannot tell how much strength you are going to have to use on a manual bar until after you have pulled it, and you do not know that on the air reverse either. I believe the amount of strength required to handle the manual bar varies more than with the air reverse.

I said I was delayed 15 minutes on this occasion that my air power reverse froze up. I made a report of that. I do not recall the date. It was three years ago. I was on an extra freight train, about 120 empties. I do not recall the number of my engine. I made my report as to the delay on the work report. I did not report it personally to any official. You must make out form 490. I did that.

You must do that, or they will ask you for it. I do not remember the number of the engine, or the date, or who was my conductor. I could not tell any member of the crew.

(Witness excused.)

1008 H. L. COSPER, of Montpelier, Ohio, age 44, employed by the Wabash Railroad as road foreman of engines, testified:

DIRECT EXAMINATION

I have been in the service of the Wabash Railroad since June 1907. I started firing in June 1907. I was promoted to engineer January 1916; I was promoted to traveling fireman June 23rd; I was promoted to road foreman March 1927. I held that position until June 1930, when I was reduced to engineer, until March 3, 1931, when I was promoted to road foreman of engines on the Detroit division. I have operated a locomotive for the Wabash from Montpelier, Ohio, to Chicago, Ill., known as the "fourth district" of the Detroit division. In my various other capacities, my time has been confined to the Detroit division only. This includes the third and fourth district of the Detroit division, Detroit to Chicago. I would say that during my experience as an engineer 50 percent of that time was with engines with power reverse gears, the Ragonnet and Alco.

A greater part of my time as a supervisory officer is in riding engines. My purpose in riding them is to instruct engine crews, to see the performance of the locomotives, to see whether or not she is performing correctly. One of the main factors of my riding engines is to observe the performance of the locomotive as it relates to fuel consumption. During the time I have been in a supervisory capacity I have ridden all engines, with both hand and power reverse gears, that the railroad has. My observation has been that the hand reverse gear does not require any great effort to handle, and from my own handling of them they are apparently very easy. Generally, dry valves are indicated to the engineer by the bar. As to what has been my experience as to handling engines under those conditions and what I have done with respect to the dryness

1009 of the valves, after noting the movement of the reverse lever and without waiting until the valves were so dry it could not be handled, I would unlatch the lever and drop her down for the purpose of giving more travel to the valve to gather some of the lubrication that had accumulated on the bushings that had not been covered in the short cut-off, and in that way I got a temporary relief, and as soon as we stopped at other times I would make the necessary repairs. As to what type of lubricator I am speaking of in mentioning that sort of an operation, I would say the Nathan and Slack which we have. They are forced feed. As to whether my handling of the lubrication would be any different with the hydrostatic, if the lubricator would become dry I would fill it. That would relieve the situation. If some other defect developed I would

make temporary repairs and go on with the hydrostatic. I have had a case in my experience when difficulty developed about handling the lever under conditions of that kind when the valves were dry or when they were getting dry. The bar would drop down to about half stroke and cause the valve to make a longer travel. There was no difficulty about handling it that I had myself or that I observed, other than that possibly you would use a little more strength on it to be sure. In all my experience I have not experienced any danger to myself or observed any danger to the other men handling it. Those occurrences are very infrequent conditions. During my experience or in my observation the experience has never occurred of the hand lever becoming unlatched on a hand lever operated reverse gear without the action on the part of the operator raising the latch. I have never experienced or observed any occasions of the lever after being unlatched getting away or pulling away or when it got beyond control of the man handling it (tes., pp. 3545–3555).

I am familiar with the clearances on the type B–8 switch engine on our line. In full forward gear, with respect to the
1010 hand-operated reverse lever, the throttle grip and the reverse-lever grip have about a two-foot clearance. With the reverse lever in mid gear with the throttle closed, the end of the throttle grip extends two inches towards the side of the cab or the window beyond the plane in which the reverse lever operates and is about three inches above the top of the reverse lever. In extreme back motion there is about a four-foot clearance.

As to the clearance situation on the type J–1 of the Pacific passenger locomotives on our line, the plane of the reverse lever is about 12 inches below the throttle lever, the grip of the throttle lever extending out to the right beyond the plane of the lever about 15 inches, towards the outside of the cab. When the reversing lever is in center position on those passenger engines the top of the throttle lever is about 25 inches from the reversing lever. There is no point at which the reversing lever may be set which brings the top of the reversing lever in closer to the throttle lever other than I mentioned in full forward gear when it is one foot under the throttle. That is the closest point. With the engineer gripping the throttle in order to operate it from his position on the seat box on either one of those locomotives, that does not bring his arm or any part of his body into a position where a movement of the reverse lever may touch his arm. It would be over and above the reverse lever. Grasping the throttle grip from his ordinary position in the cab on the seat box, when the throttle is closed and the engineer is grasping it to pull it further over, the throttle pulls back towards the back of the cab, not towards the engineer. There is plane there. It comes around in a quadrant circle like that [illustrating]. As he pulls the throttle lever out he pulls the grip part of it closer to him in a way. It swings to the left also.

As to my experience and as to my observation with respect to the handling of engines just after they have received general

1011 repairs in the shop and after they are just placed in service, we have a great number of engines returning to work from the shop that we do not receive any reports on [at] all. We receive a few of them and get reports on them as to handling hard. I have in mind a particular case with respect to an engine in that condition of just having been received from the shop where we had reports on its handling hard. It is a rare case or an extreme case, I might say. In September 1930 we received an I–3 engine from the locomotive shops, and after arriving at Montpelier it was placed in white lead. It was taken out last winter and placed in service, and we received reports from the engineer six days that the engine was handling hard. Since that time there have been no more reports. I handled the engine during the six-day period when reports were made, and after the reports were made. I was called on about the fifth day of this engine in service and handled the engine and made a report on it myself, and the work was done in the roundhouse and the defect corrected. The caps on the tumbling shaft box were taken up and shins placed under them and replaced, and it worked all right. Prior to the time when we did that I handled the engine and threw it over. There wasn't any extraordinary effort in handling it. Sitting on the seat box in my usual position, I could take hold of it and throw it over. I used both hands in doing it. I handled it after we made the adjustment of the tumbling shaft box. It handled much easier afterwards. I have handled that class of engine from time to time during my experience. As to whether I used one hand or two hands and to what extent I exerted myself in doing it, after that class of engine is broken, a man can handle it very easily with one hand. The weight of the I–3 engine is 198,500 pounds on drivers.

During my experience I have had occasion when valves became broken in the course of operation over the road. I have in mind one case when a valve ring broke. We were running along
1012 about 25 miles an hour and the valve ring broke. I never knew it in the cab other than to blow the valve. There was no effect noticeable on the hand reversing lever. The engine was equipped with the hand reversing lever.

We have three or four elderly men whose ages range from 68 to 72 years who are running I–3 engines. Two of them in the Detroit yard and one in the Montpelier yard. The shifts on those jobs on which these men are working are eight hours. They work seven days a week. As to these elderly men who are running these switch engines equipped with hand reverse, they are the senior men on the seniority list and they would be free to bid in any job they choose in the same territory. There are other jobs in the yard service, the same type of service in which they are now working, which they could bid in where they would have an engine equipped with power reverse gear.

I have had experience with freezing of power reverse gears. I am unable to give any specific date other than the year. In 1919 I was

running engine no. 2202, a K–2 engine. We were running about an hour and thirty minutes and in this time it was not necessary to shift the lever due to good running ground. We made the point of North Liberty, Ind., for one of our passenger trains, train no. 12, and I slowed the train down and the brakeman was able to get the switch over without stopping, and we pulled into the clear slowly, and when we got the train into the clear the brakeman was able to cut the engine off without getting slack. We had five minutes to go back to the rear end of the train where the water plug was stationed and get water. The brakeman threw the switch and let me out on the main. When I came to reverse the engine it was stationary. He at once went out to flag, while I was finding out what the trouble was. The reverse cylinder had frozen. I took the scoop shovel and some waste with tar oil and thawed it out. That took about seven minutes. There was about seven minutes' delay
1013 to the passenger train. They had arrived before I finished. The passenger train was within a safe distance when it arrived with respect to my train. They were flagged by the head brakeman on my train.

On our line, we do not have a steam pipe connection to the air reverse gears now. We did have. There was a pipe connection leading down from the fountain on the ride side of the boiler just inside of the cab and connecting into the air supply pipe about two feet from the air cylinder. We have one shut-off cock at the fountain valve and the intermediate valve. They were taken off about in 1922. As to the reason, we had several cases where the steam valve to the air reverse was accidentally opened by the roundhouse men, admitting steam into the air cylinder and the brake system, and this burned out the packing in the reverse cylinder and the piston packing and we found it also dried out and burned out our main body gasket in the automatic brake valve (tes., pp. 3555–3565).

I have not at any time in my experience or observation had any difficulty with the hand operating reverse gear freezing up. I was always able to maintain a fixed point of cut-off on the locomotive with the hand operated reverse gear. As to my experience in that respect with the power reverse gear, I have had experience with the power reverse creeping. After you have reached the stop which you wish to maintain and hook the engine up to cut-off a creeping takes place, which allows the link block to go down to a point that increases the travel of the valve. That is very hard on the fire and at times it tears holes in the fire, possibly causing a delay later on to clean your fire, and it is a waste of fuel. On those occasions when I experienced creeping I have noticed a difference in the movement or speed of the locomotive. The valve makes a long travel and creates a back pressure, slowing up your locomotive. As
1014 to how creeping has the effect of tearing holes in the fire, assuming that the train has gained a speed of 25 miles an hour and creates more valve travel it makes a heavier exhaust, which creates more draft in the fire, tearing holes in it. As to what I have

done when operating an engine that was creeping to overcome that tendency, it is natural for a man to want to keep a constant cut-off, so he pulls the lever back. About the time you get it back and you notice your exhaust decreasing you have to put your lever down where it was in the beginning. It is a process of repeated adjustment of your operating lever all of the way over the road when you have a gear that is creeping. This creeping does not happen every day nor with every engine, but we receive several reports in a months' time on creeping.

I attend every one of the fuel meetings we have on our railroad. They have them once a month. There is rarely a meeting at which some engineer does not bring up the point of reverse-gear creeping on some engine that he has handled during the month or the week. My experience with engines creeping is that when an engine creeps, because of the heavier exhaust it creates more draft on your fire, and, of course, burns more coal. I note this by the speed of the stoker.

My experience has been that the creeping is forward. I have had experience with and observation of the Ragonett and Alco power reverse. We have had experience with both of them creeping. The Ragonett was more frequent than the Alco. We have the G-type Alco. I cannot say as to the type of Ragonett. It is an older type. They received it in 1918. With respect to creeping, I would say that the Alco is more efficient on account of the rotary valve. It does not creep as often as the Ragonett. The Alco creeps 40 percent less than the Ragonett.

As to the efficiency and economy of locomotive operation as between the hand lever reversing gear equipment and the
1015 power reverse gear equipment, my opinion is that the hand gear is superior to the power gear due to the fact of creeping of the power reverse gear. As between the two types of reverse gear from the standpoint of safety, I think one is just about as safe as the other. I am speaking now with respect to the man in the cab. From other standpoints of safety, I would say there is a difference between the two, the hand gear is safer because it will not leave its position on the quadrant without being moved by somebody.

CROSS-EXAMINATION

If the hand lever should jump out of the quadrant and go to the corner, that would not change my opinion as to whether it is safe. I wouldn't be in front of it. I have never seen any engineer in any position in the cab in which if the lever went from one corner to the other he would have been struck. I have never seen any part of the engineer's body get in the line of the lever as it would move over the quadrant from the back to the front corner. I don't know that I have ever seen an engineer put his foot on the quadrant. I have never seen him cross over across the quadrant.

I have 110 engines under my supervision or in my territory. I have ridden on all of those engines in the course of time. I have measured one of them with respect to these distances between the throttle and the reverse lever. But they are all put up the same. On that class our measurements are all the same. There is possibly a half an inch or so variation from that on some engines. We have nine classes of engines in those 110. Two of those classses have the lever alongside of the boiler and between the cab window and the boiler, that is, directly in front of the engineer. The other quadrants and levers are to the side and to his knee. We have one class where the lever is behind the boiler head. On that class
1016 when the lever is in extreme forward position it is two and a half inches from the boiler head. We have a stop clip on the quadrant. If that stop pin were missing, the lever would not touch the boiler head when thrown in full gear. It would come quite close, possibly. As to how close, we have a one-inch stop. It is three inches from the boiler to the end of the lever. I don't know that I ever have operated one of those levers with the stop clip off. As to how close the levers are to the back board of the cab in the rear, on that J–1 engine you are speaking of, it is to the inside of the back of the cab I would say about 15 inches. It is like this. Out this way [indicating]. Here is the back board right behind the engineer's back. It is out here [indicating]. The lever does not extend on out into the gangway. It extends right here [indicating], in back motion. The arch of the engine would be right at the engineer's back, across here [indicating]. Here would be the arch. It does not go as far back as the back board. We haven't any class on our division where we have a notch or a hole cut into the back board to accommodate the lever. I guess we have on our road, but not on my division. I couldn't say how close the lever is to the side of this cut-away portion (tes., pp. 3565–3575).

I have never observed any engineer with whom I was riding have any difficulty in handling a manual bar. I have seen them take both hands to handle it. We have a foot brace on our locomotives at the end of the quadrant or near it. The engineers rarely ever use that foot brace when they are handling the lever. It is there because the engineers requested that it be put there. They made the request of me and the roundhouse foreman. The only reason that they gave for wanting the foot brace was to have a stop to put their foot on. I could not say who it was that made that request to me. That has been 24 years ago, I heard the request made, and to myself on engines coming out of the shop four years ago. I heard of
1017 putting the brace down 24 years ago. Engineers made the request then. They did not make it of me, but I heard of it then. I did not make the request 24 years ago. I was not running then. I was road foreman, Detroit terminal, on this occasion four years ago. The engine had just returned from the shop; it was handling a little hard in breaking in and the engineer requested one be put on, and we put one on for him. I was in the office when

the request was made. I couldn't say whether anybody was in there with me. I don't recall the engine number. Schlomer was the engineer who made that request. I believe his initial is H. He lives in Detroit. He is working there now. The reason he gave for wanting to put his foot there was that the engine was just out of the shop and was handling hard. I couldn't say that it was for a brace.

I have observed these elderly men who handle the switch engines I spoke about, in their work. I have been with them. None of them at any time has had difficulty in handling the lever. I have never assisted them in doing it or observed anyone helping them.

On this occasion, when I was handling this switch engine that was reported handling difficult for six days, I handled it on the west lead, Montpelier yard. The number of it was 2328. As to how many times I handled the lever, I switched for an hour. I couldn't say how many switches we made. The engineer or fireman did not assist me to throw over the lever in any way. D. Lash was the engineer on that locomotive. I remarked to him that the engine handled hard and "we will have her repaired tonight."

The names of these three old engineers to whom I refer are F. Glover, Detroit, Mich., J. Wurtsmith, and S. J. Jackman, Montpelier, Ohio. I can't say that either of these three told me that they stayed on these engines because they had manual reverse rather than going on one with power reverse. As to whether Mr.
1018 Glover can get another trick in the same yard and the same hours in Detroit on an engine that is power reverse, I don't know that he would get the same hours, but an hour earlier. Mr. Wurtsmith can get a similar trick on an engine that has power reverse. He can go to work thirty minutes later, the same class of work. Mr. Jackman could get an hour earlier job on an engine that has power reverse, in the same yard and the same class of work, but not on the same lead, though.

With reference to this case where the power reverse froze, I said that I drifted into the side track and the brakeman opened the switch without the necessity of stopping, and when I stopped I had five minutes to come back to the rear end of the train and get water. That was a North Liberty, Ind. That is single track. I was the engineer on that train. The clearance rule on the Wabash Railway is five minutes. I was in the clear at the required time, and I came out on the main line in the face of a passenger train. I had five minutes when I stopped. I cut off and went out on the main line. When I discovered I could not reverse my engine I had about four minutes. I did not blow my flag out; I called to him and he went out. I would say he went out 20 telegraph poles. He stopped a passenger train and I delayed them seven minutes. I was not disciplined for violating the rules. I don't recall who was my brakeman or conductor on that trip. I couldn't say what date it was. It was in 1919. I remember the year. The delay to the

passenger train was reported by the operator. I didn't make any report. The operator was a man named Sutton, at North Liberty, Ind. R. F. Will was the engineer on the passenger train. I delayed the passenger train about seven minutes. I was not called in for a statement as to the delay to the passenger train (tes., pp. 3575–3585).

I have never seen an engineer pass across the plane of motion of a manual reverse bar. By the "plane of it", I mean the sweep of the lever. The quadrant is located to the side of and over forward with respect to the engineer's seat. The plane of the lever extends behind him or alongside, like this [indicating]. The deck of the engine is on the other side of the quadrant from the engineer. The one I am speaking of, the quadrant is back of the boiler and the whole sweep of the reverse bar is back of the boiler. The engineer gets out like this [indicating] and walks around back of the quadrant. All of the time I ever noticed them they always do that. I noticed that just like I would have noticed anything else. I don't know why an engineer does it. I don't know that it would be easier simply to step over the quadrant. He can turn around like this [indicating] and step right off and get a drink of water, which he generally gets off of his seat for. I have never seen an engineer pass in front of the manual bar. As to whether I would pass between there, I don't know why I wouldn't if I wanted to get across. I don't know that they are so particular about not getting in the plane of the manual bar. I don't know that it would be an unwise and dangerous practice to get into the plane of the bar. Assuming a condition where the lever is working a little hard and the engineer wants to hook her up and the engineer gets with his back to the back head of the boiler and puts his hand on the manual bar to push it up another notch, I have no opinion on the safety of that. I have not been told not to express any opinions.

If I desired to hook up the manual lever a little higher when it was in forward motion and my engine running along and the manual lever worked hard, I would not get between the back of the boiler with my back to it and my hands on the lever and attempt to push it up. That would be impractical because you hook the lever up from the position on the seat. I would think the fact that I usually do it from the seat box would make it impractical to do it in some other way. You could stand up in the deck on the other side of the reverse lever if you preferred. It would be all right. I would get in front of the lever and push it back if I wanted to. If I saw a student fireman, on perhaps his first or second trip on the road, get into the position described to handle the manual lever, I would instruct him not to get in between the lever and the boiler head because he could go around the other way, the rear end. That is the only reason. I don't know why it would be dangerous to go between the lever and the boiler head (tes., pp. 3585–3595).

I said that we hold fuel meetings about once a month and that there is not a meeting at which an engineer does not bring up the matter of excessive fuel consumption because of the creeping of power reverse. The last meeting I attended was the 26th of May at Detroit. Engineer Goon brought up that subject at that time. He lives in Detroit. I believe his initial is H. I am not quite sure. You can get him at the Wabash roundhouse. As to what particular occurrence there was that caused him to bring up the subject of excessive use of fuel at the fuel meeting, that is one of our fuel subjects. Even the slightest creeping we request our men to report. I am pretty sure the 26th of May was the date of the meeting I attended last. It was at Detroit, Mich. As to whether this engineer had had some bad case of creeping that prompted him to bring up this matter, I don't recall the engine number, but he said he had an engine a trip or two ago that was creeping and it had been reported in Detroit. As to what connection that had with fuel, creeping increases the valve motion, causing the engine to work harder. When it works harder it burns more coal. This was a stoker-fired engine. The engineer had not been criticized for excessive use of fuel. There were no other engineers who brought up the same subject at that meeting. He was not the only engineer
1021 who had a creeping reverse gear during the preceding month. We had several reports. I say that that is what these engineers should do. They are not required to do it, but they are requested to do it. The meeting before May 26th was a month previous to that. I don't just recall the date. The dates are always set in advance, and we attend. I couldn't say what engineer brought up the subject in the April meeting. I don't remember all those things. I can recall one engineer who brought it up at another time—W. P. Ferguson. I don't recall the date, but it was in 1927, engine 2202.

As to whether our instructions on the Wabash with respect to fuel consumption go to the engineers or to the firemen, every employee on the railroad is instructed to do his best to save fuel. The firemen attend these fuel meetings. In the event of excessive fuel consumption, the person or department responsible for the excessive amount of the use of fuel would make the explanation. As to who would be called upon to make the explanatioin in the event of excessive use of fuel on a particular trip on a particular locomotive, if the excessive amount of use of fuel was due to bad delays it would be charged to dispatching. It it was caused by excessive switching it would be the trainmaster; if it was caused from other irregularities, possibly the road foreman or trainmaster would answer for it, but if the engine was defective the engineer would report the engine. We keep a fuel record by engines. As to whether I go over these fuel records of the various locomotives on my division, we have a fuel clerk in our office and he gets a report every morning. We know every morning about what each engine uses. When it seems from the report that the fuel consumption for a particular engine is excessive,

I go into the matter and see what caused the excessive use of fuel. There are times when it is heavy tonnage, excessive delays, and you cannot call the engineer and fireman to account for that. If
1022 I find it is the engineer and fireman then I call them in and instruct them in the proper manner of handling their engine and saving fuel. The fireman can waste a good deal of fuel with the stoker. Indeed I criticize the fireman on account of excessive fuel consumption. No fireman has ever undertaken to excuse the excessive fuel use by stating that the power reverse mechanism was creeping and that that was the cause of the excessive use of fuel.

The passenger train which was delayed seven minutes by reason of my power reverse gear freezing up was train no. 12 (Tes., pp. 3595–3606).

REDIRECT EXAMINATION

As to whether the engineer in my experience reports increased fuel consumption from time to time on account of the creeping of the power reverse, it is not reported in just that way. It is "engine creeping", and if it is not corrected that one time, then he comes to the office and advises that that engine is burning a lot more coal than the others, due to creeping. Firemen do occasionally make a report of the consumption due to creeping.

With respect to the comparative amount of work done by the switch engines in the Detroit terminal, in my district, and whether in my experience the equipping of any of these engines with the power reverse has resulted in their being used to better advantage to enable them to perform more work in a day's switching after they were equipped with power reverse than when they had hand reverse on them, you cannot do as much switching in an eight-hour period with power reverse as you can with the hand reverse. That has been my observation of these engines in that terminal.

RECROSS-EXAMINATION

I couldn't say as to the percentage of increase of fuel consumption by virtue of creeping power reverse gear mechanism. I couldn't say whether it is increased 20 percent by virtue of creeping.
1023 We keep a fuel record of yard engines. We have no stoker fired in the yards. We keep a daily record of the coal consumption of each locomotive. As to whether I have observed how much more fuel will be used on the same locomotive when the power reverse is in its best condition and when it has been complained of as creeping, it is some more coal used in creeping. I couldn't say about the percentage. I have none of my records here.

We have 18 switch engines equipped with power reverse in my territory. We have two that are 198,500, eight that are 217,400 pounds, and eight that are 223,000 pounds. Two of these power reverse equipped engines were manually operated. I know that they

switch less cars when they are power operated than when manually operated by making tests. I made such a test.

"Q. When was that?

"A. Power reverse gear requires four seconds to reverse it."

That is the Ragonett type.

"Q. Is that what you base your answer upon—the length of time it takes to throw over the lever?

"A. A manually operated gear, one second."

I did that timing myself. I started to time the movement of the lever from the time the engineer placed his hand on the lever until he took it off. With the manual reverse, when I started the watch the engineer's hand was going after it like that [illustrating] and going over, and when he took his hand off [indicating]. I tried to get it just exactly the time he put his hand on as I did with the power gear. In the yard service the engineers sit down to handle the manually operated lever; that is their preference. They do not always do that. Assuming that the engine is in back motion, sometimes the engineer sits facing forward, sometimes back to the outside window. Facing forward he has his head out of the window.
1024 Facing back it is not out of the window; he can look both ways from his position on the seat.

"Q. Will he be facing with his back towards the front of the cab when he is in back-up movement that way?

"A. If he is facing forward he gets around this way [indicating]. If he is facing forward he is this way [indicating]—forward and back."

Assuming he wants to reverse the engine, he does not necessarily have to bring his head in from outside the window. You can throw the lever from full backward motion to full forward without taking your head out of the window. You cannot do that under all circumstances. I occasionally bring my head in. As to whether, if you bring your head in, it takes a great deal longer than one second to make that movement, I think I timed it from the time he put his hand on the hand lever and then threw it over, not from the time he drew his head in.

"Q. You timed it then only in one position?

"A. From the time he started the reverse until he finished the reverse.

"Q. In going ahead motion if he was sitting on the seat box?

"A. Both ways."

I timed it in back-up movement when he had his head the other way. I took it as they came. This test was made June 2nd, 1931. The names of the engineers are C. A. Kimmell and A. C. Montgomery. They live at Montpelier, Ohio. On the occasion of that test we switched 54 cars in one hour. I did not take a day's test. That was with power. We switched 62 cars with the manual bar. They were not the same engineers. Those engineers were H. Hodder and G. Elkins. I did not make this test on the same day; that test was made

on June 3rd of this year. Hodder was the engineer of the manual and G. Elkins was the fireman on the manual. I made this
1025 test to find out which one we get the best service out of. That was the only reason. I did not know I was coming down here to testify. I had not been informed as to anything about this case. I had heard that someone from our road had testified in this proceeding. I knew about the case; I read about it. I had been furnished a copy of the testimony of men from my road who had testified. As to whether that was the purpose of running that test, I wanted to know myself. I did not tell these four men anything about the purpose of the test. I did not inform them that I was making the test (tes., pp. 3606–3615).

June 27, 1931

REDIRECT EXAMINATION

The entire figures of the test I mentioned of these three or four switch engines are: Engine no. 1554, Engineer C. A. Kimmell and C. A. Montgomery. This test was made for one hour, starting at 9:18 a.m. The average length of time for the throw of the lever on that engine with the Ragonett power reverse was four seconds. No. 499, a B–8 engine, H. Hodder and G. Elkins, fireman, the time consumed in reversing the engine was one second. It was one second each time he threw the lever. He threw it 38 times in an hour. He switched 62 cars in that length of time. There were 18 kicks when it was not necessary to move the lever. As to what I mean by kicks, the cars did not run over the switch. They were able to switch out another car without backing up. There were 54 cars handled during the hour with the power-reversed engine and four kicks. Engine no. 4330, I–3, a hand lever-equipped engine, Engineer Getty and Fireman G. Ramer. The average time consumed in reversing the engine was two seconds. The engine was reversed 14 times in an hour and 42 cars handled. Engine no. 2328, a hand lever-equipped engine, Engineer W. C. Reese and Fireman C. A. Kimmell. The average time consumed in throwing the lever was two seconds. They handled 60 cars. The hand lever was reversed 25
1026 times during the hour and one kick. These four jobs on which I made the tests are average jobs. They are about the same with respect to the amount of switching as the general run of work in the yard. They are the average.

RECROSS-EXAMINATION

As to the character of work these yard engines were performing, engine no. 1554 was working on the east lead in Montpelier yard. Engine no. 499 was working on the house job, Detroit yard. Engine no. 499 was manually reversed and no. 1554 was air reversed. One of them switched 62 cars and the other 54 in an hour. They kicked 18 without making a switch, without reversing the engine. I did

not take any record of just how many cars they cut off each time in a bunch when they made a kick. That varied to as many as five and six and sometimes more. It possibly did happen that the air-reversed engine, if it had cut off as many cars at each kick as the hand-reversed engine, would have handled as many cars in an hour as the hand-reversed switch engine. It might have been more. I don't know as to that. I could not tell. When I talk about kicking I mean they slack ahead a little and sign the man down. As to whether they cut off five cars with the hand engine and one car with the air-reversed engine, I would say that would just about balance itself. One time they would cut off one with the hand power, and possibly five with the air reverse, and vice versa, and five with the air reverse and one with the power. I was sitting in the cab. I don't know exactly how many they cut off at a time.

If the man is on the job, every time he reverses the hand reverse engine it is performed in one second. The manual reverse is quicker than the power reverse. With the manual reverse the men can perform more switching and they do if the cars are there to switch. We have both manual and power in the same switching yard. Assuming that both engines have all of the cars that they
1027 can switch during the two periods, the man with the manual reverse switches 20 percent more in a day's switching than the man with the power reverse. It takes the power reverse four seconds and the manual reverse one.

REDIRECT EXAMINATION

Twenty percent is merely an estimate I have made in response to counsel's insistent questions. The throwing of the lever completes the switching movement with the manual gear. There are things other than the time it takes to throw the reverse lever that influence the number of cars a man can switch in an hour—applying the brakes and releasing the brakes on the engine, opening and closing the throttle. All of those matters would be the same whether you had the hand reverse or the power reverse; it would be balanced on each side (tes., pp. 3616–3628).

(Witness excused.)

T. B. REDDIX, of Moberly, Mo., age 35, employed by the Wabash Railroad as assistant master mechanic, testified:

DIRECT EXAMINATION

I have worked for the Wabash Railroad approximately 20 years. I entered the service with the Wabash October 1, 1910, as a machinist apprentice, serving four years in that capacity. On October 1, 1914, I was rehired as a machinist. On October 17, 1917, I was promoted to a supervisory position in the back shops. In 1918 I was assigned to duties as assistant roundhouse foreman, Decatur roundhouse, at Decatur, Ill. All of this service is at Decatur. In

March 1919 I left the service of the Wabash and entered the service of the Chicago & Eastern Illinois Railroad as assistant night roundhouse foreman, Pilla Grove, Ill. In March 1920 I again reentered the service of the Wabash as assistant night roundhouse fore-
1028 man at Decatur, Ill., serving in this capacity until August 1925 when I was promoted to be roundhouse foreman at Decatur, Ill., serving in this capacity until February 1, 1928, when I was promoted to general roundhouse foreman at Decatur, Ill., serving in this capacity until June 15, 1931, when I was promoted to assistant master mechanic for the Moberly and Western division or lines of the Wabash Railroad, with headquarters at Moberly, Mo..

I am familiar with the J-1 type of light Pacific locomotive on the Wabash. Engine no. 664 is one of that class. I can recall one specific instance on May 4, 1929, when I made measurements on that engine around the grip of this reverse lever. The I.C.C. inspector, of the Bureau of Locomotive Inspection, was present at one time when I made the measurements. I measured it more than once. There was no difference in the measurements. I found that there was two inches of clearance, two inches to two and one-thirty-second inches clearance between the grip of this lever and the injector steam pipe, the closest object to it. I did not measure the distance to the boiler head. The boiler head is approximately six inches from the grip of the lever. This engine 664 was the one as to which J. R. Adams testified to an injury he received. I have measured the clearance between the levers and the boiler heads on other engines of the same class as no. 664. I found that there was no place that the lever was closer than two and one-eighth inches from any part in front of the lever. On all of this I am speaking with respect to the lever being in the full forward stroke. On this engine no. 664 or on the other engines of that same class that I examined the boiler head was not any closer to the lever down next to the quadrant than it was closer to the grip. To the best of my recollection the in-
jector pipe was not any closer to the hand reverse lever on
1029 engine no. 664 at the quadrant than at the grip of the lever. I did not make positive measurements. There might have been a small variation in the measurement of two inches but it was not as close as a fraction of an inch. There was no defect reported found by the Federal inspector who was there with me at the time I made the examination (tes., pp. 3628-3638).

After this accident was investigated, I did not make any changes in the clearance around the lever or make any other changes in the cab arrangement. If the inspector had given me a form 5 requiring the work to be done I would have to do it before the engine was returned to service. The engine was not kept out of service after that time. On that engine no. 664 and on the other engines of that class it is feasible from a mechanical standpoint to set up a foot brace on the boiler head or attached to the boiler head in some way. That engine was later equipped with an Alco gear. There was room for a foot brace. I would stud the foot brace onto the boiler

head. I would locate it to the right of the lever in the extreme forward position. It would be feasible to move the steam pipe leading to the injector. If desired, a guard of sheet metal or other light material could very easily be placed on the outside of the boiler head and extending backwards between the quadrant and the side of the cab. The expense of putting on such a guard would be between $10 and $15. The expense of moving the injector steam pipe back so that you would have a clearance from the lever of six inches would be approximately $5 or $6. The quadrant on all that class of locomotive had a stop block at that time when they were equipped with the hand lever. At the time of this accident there was a stop block on the engine at the front. That stop block which was in there when it was equipped with this hand lever could have been made wider and in that way secure a greater clearance between the lever and the injector steam pipe. The expense of doing that would be probably 50 cents. I would say that it could be
1030 widened enough to give between a five- and six-inch clearance, or somewheres along in there, from the injector steam pipe in the position in which it then was.

In my experience in the roundhouse and shop on our railroad I have taken care of the maintenance and repairing of the various types of engines on the Wabash which are equipped with the hand lever reversing gear. On the different types with which I have had contact this change can be made wherever it was necessary to get any greater clearance between the hand lever and the boiler head or other objects at the forward position of the lever. As to whether these estimates which I have given of approximate cost that would be involved in making those changes would vary on the other types of locomotives, changing the stop block of the quadrant would not have any variation that I can see. I mean the 50 cents. All that the stop block is is just a short piece of iron with a hole drilled in it for a bolt to go through. As to whether the estimated cost of moving pipes would vary on different classes of power, I don't know of any power outside of this class of which we are speaking on which it would be necessary to move an injector steam pipe to get that much clearance. The placing of foot braces would be practicable on all of the classes of power equipped with the hand reversing lever on our railroad. If the stop block were widened so as to get the increased clearance, there would be no object in moving the pipe to a further clearance. You could do either one or the other. We would not put a machined block on there, only so far as drilling is concerned. That would be machined. And so far as the length of the piece of iron that you would use is concerned, you would merely cut it off to a very close dimension in a pair of shears and square it up on the emery wheel on one end.

As to the character of maintenance work and the way in which power is maintained on our railroad now as compared with the
1031 early years of my experience, I will take it from the roundhouse experience. My first supervising experience in the

roundhouse occurred in 1918. That was the first. The power was not maintained at a high standard, that is, at the high standard that it is now. The material that is used now is of a much better grade and lasts longer. I am referring especially to hand power reverse gears or reverse levers. The latches and the quadrants are made out of better material. We have a highly improved method of hardening, which insures a longer-lasting latch and quadrant than formerly. Several years ago, with the hand levers, they were not maintained up to a high standard, and they gave some trouble. In the last few years we had practically eliminated trouble with the hand reverse gear due to the upkeep of the valve motion and all of the reverse-gear parts. And, as I stated before, there is the better material used and the improved methods of hardening these different parts that need to be hardened.

As to what kind of work we do in maintaining the power reverse gears in the shop and roundhouse, we have numerous reports on the power reverse gear of floating or creeping. It is necessary to maintain all of the pins and the different levers on this gear from lost motion; we have piston-rod packing leaking, we have rotary valves leaking, worn pins in the reach rod, and the vibration of the reach rods, making it necessary on our higher-speed engines to turn and bore bushings and put in these braces so the reach rod will be just a sliding fit through them. We have the studs to leak where the brackets are bolted onto the boiler, and the reverse gear cylinder packing leaking. There are approximately 9 wearing parts on the hand reverse gear and approximately 25 on the Alco power-reverse. We have had one Barco gear on the Wabash, in my experience, and we have two Ragonett gears in service at my terminal now. It is principally Alco with which I have had experience.

1032 As to the comparative effect of lost motion on the hand-lever reversing gear and on the air-reverse, it takes very little lost motion in an air reverse gear to cause the gear to become defective. On the air reverse gear this is due to a very slight lost motion in the pins or the small reach rod will cause a vibration which, in turn, will cause the rotary valve to move on its feet, causing the gear to float. A small leak at the piston packing will also cause a movement of the piston, which, in turn, will cause the rotary valve to move off of its seat. When the rotary valve moves off of its seat the main piston in the power reverse gear will move in the direction that the inlet port is open. It is the lost motion which causes a vibration and leakage at the piston-rod packing that affects the opening of the inlet port. It is necessary to maintain the moving parts on the power-reverse at a slip pit. What I mean by that is that your pins must be maintained and made so that they will just go into the bushings. With the hand lever it is not necessary to maintain the fit of the various working parts up to a high standard, that is, to as close a fit as it is on an air-reverse (tes., pp. 3638–3649).

As to whether I have found any difference in the amount of wear which has taken place on the hand lever equipment as compared

with the power reverse, there is much more wear on the pins in the reach rod where it connects to the lift, shaft arm and the power reverse gear crosshead than there is on the reach rod on a hand reverse gear where it conects to the lift-shaft arm and where it connects on to the reverse lever. The reason for that is that on a hand-power reverse gear you do not exert the power and the slam against these pins that you do on an air reverse gear, especially due to the floating of the power reverse gear, which is a very hard strain on these connections. As to what efforts my company has put forth in the maintenance of power reverse gears at the Decatur
1033 roundhouse where I have been in charge, we make every effort to maintain all parts of our gears. I personally inspect engines at my terminal, sometimes one day a week, sometimes two or three days a week. I inspect them on the out and on the inbound tracks. When inspecting these engines, it comes within the line of inspection to inspect throttle latches, reverse gear quadrants and latches along with all other apparatus in the cab that can be made by inspection. In addition to my own inspection, we have one mechanic on what we call the daylight shift whose entire time is consumed in maintaining these gears. When an engine arrives at the roundhouse he immediately goes over this gear to discern any defects which are not reported by the incoming engineers. He does not handle all of the maintenance work on these gears. He does not have time to handle all of the maintenance work on these gears. We have several other mechanics who do work on the gears that he does not have time to get to. This special mechanic who works on reverse gears has been on that kind of work practically ever since the old Mellin gears were received on the Wabash which, to the best of my recollection, was probably back around 1912.

I said we had one Barco gear. I have had contact with the service men representing the manufacturers of that gear. To the best of my knowledge I would say we have had that Barco gear approximately five years. These service men have had personal contact with this special mechanic who maintains the power reverse gears in the Decatur roundhouse. That has been numerous times. The results, so far as eliminating the reports with respect to the creeping of the power reverse gears in my territory or power that I maintained at that roundhouse, have been very poor, as the gear gave an enormous amount of trouble due to creeping, and with the work that we have done on the gear and the work that has been suggested to be done, which we have done, by these representatives, it has not overcome the trouble with this gear creeping.
1034 I am speaking in regard to the Barco gear on that question.

The Alco gear also creeps just the same after we have made the suggested repairs by this company. The latest gears we have on the Wabash are the Alco. The last gears that we received came on our "O" engines. They have been in service since January—part of them. Our experience with these gears that came in January of

this year has been that they give us an enormous amount of trouble due to creeping and floating. That is the common phrase as used by the enginemen in reporting them. Floating and creeping is practically all the same. That Alco is type E, the latest type. The G type was the one that we had in service before the type E gear came on to the market. The only difference between the type E and the type G is the piping of the air reverse, that is, the piping of the air and the location of the air reverse valve. The old-type gear had the pips [pipes] running from the valve going into the cylinder and the new-type gear has these passages cast in the cylinder.

CROSS-EXAMINATION

We have had 18 of these type O engines that have seen service in our district. I cannot say how many work reports I have had where creeping was reported on that class of engine. I wouldn't say that I have had any this month. I haven't had time to check work reports this month. There is a numerous amount of them, but I never stopped to count them up, and I wouldn't want to give you a figure on how many there would have been since January. By "numerous" I mean a lot of them. I would not attempt to give you an estimate on the number of them that have been reported creeping because I do not see all of the work reports that are reported. Some of them I do. I see enough of them that I know they are numerous. I wouldn't give you a figure on how many I saw in June working
1035 on the power reverse because I couldn't. Walking through my roundhouse that is my regular line of duties, and during the first part of June I have seen my reverse-gear man working on the power-reverse gears of the O–1 engines. I cannot give you the date and the day. I will see him doing that every day if I walk through the roundhouse. If I see that man in person I will find him working on a reverse gear. I mean that he does it every day on some of the O-type engines. That is working on the power reverse. I wouldn't say whether I have seen him working on the O-type engines 20 times in the month of June. I have seen him more than once. I wouldn't say whether I have seen him 15 times or more than twice, because I cannot give you a figure on how many times I have seen him. I did not keep track of it. I would say that in the month of May I read work reports mentioning reverse gears floating on the O-type engine. I couldn't say how many times. I couldn't say whether it was 20 times. I could not say whether it was more than two times. I didn't keep any track of it. I wouldn't say how many times. But it is numerous times. "Numerous" would range anywhere from one to a hundred.

"Q. Is that the way you see them, either one or a hundred, Mr. Riddix?

"A. Each time I go through the roundhouse if I notice this man in particular I find him working on power reverse gears."

I will see him on the O type or the M type. They are new engines, too—or some other type engines we have equipped with the power

reverse gear. I couldn't tell you how many times on the O type in the month of May. I wouldn't give you an estimate on it. I will see him one day on a O-type engine, one time when I go through the roundhouse, and maybe the next time I go through the roundhouse and notice him he will be working on a K-type engine. I didn't check up on the number of work reports I have on these O type
1036 power reverse gears when I was coming here to testify, because I didn't think it was necessary. I did not check up on the items of expense, for coming down to this trial, that these suggested repairs to manual reverse would occur [incur]. I had items of expense checked before I even knew that there was a trial of this kind in Washington. I had not figured out how much it would cost to put on that foot brace before I came here. I could tell you that from just the general run of machinist's work.

I made the measurement as to the clearance on this class of engine that Mr. Adams was injured on, on May 21st of this year, because I was coming down to this trial. I did not make any investigation of the maintenance work on power reverse to get the actual figures, not for this trial. I say that there has been an enormous amount of trouble. I could not tell you how many times the O-type reverse has been reported in the month of June, for the simple reason that I haven't time to distract my attention from my more important duties to check the amount of times that this work is reported. I had gotten up figures on the cost of material on this maintenance. That comes in on monthly reports, that is, on orders. I have worked up specific reports on the materials drawn and used from the storeroom in the maintenance of power reverse. On some different occasions we do that on any repairs. On some occasions we do the same thing on pump repairs. We do not do it on all occasions (tes., pp. 3649–3660).

In the last three years I have not had any engines ordered out of service on which the inspector found the hand reverse gear defective. I have had one manually operated reverse gear reported to me as defective by the Federal inspector in the last five years. That was February 1928. This was an engine just out of the locomotive shops and just overhauled. The Walscheart gear had just been applied to this engine. It was an Atlantic-type engine. After making its
1037 first trial trip, which was in local freight service, double heading, the Federal inspector inspected this engine, and he gave us a defect, due to the gear handling hard. The cause of this was because the gear was absolutely new all over. We had not arrived at the proper dimension of the counterbalance spring for this engine. That engine was no. 617.

I cannot remember any work reports from our engineers on manually operated reverse in the last year. There might have been a few that I did not see, but I have had none called to my personal attention. I have made an investigation of that subject. I check work reports every day. I do not check all of them but I check enough of them to know the general run of the work. As assistant

master mechanic I will do that now. In the supervision of the roundhouse on the terminals you have to make those checks as to what is going on.

I have never been an engineer. I have not ridden engines over the road any amount to speak of whatever. I said that very little lost motion will cause the air reverse to become defective. By "defective" I mean it will cause it to creep or float. If the piston moves a small amount I would call that creeping. I say that it is not necessary to maintain as close a fit on the hand reverse as it is on the power reverse. As to whether I have in mind by that that the hand-operated lever will throw the engine whether the fit is close or not, either one of those will accomplish the work of throwing the engine, as far as throwing the engine is concerned, regardless of the fit, that is, any fit within reason. As to whether the only thing I have in mind is the performance of the lever in operating the reversing gear when I say that they are or are not defective, I should think that would take in the operation of the gear under running conditions of the engine. As to whether I know what the running conditions are over the road, I can draw my con-
1038 clusions from a mechanical standpoint of the engine. As to whether I know from my experience, I have ridden a few engines. I do not know the operating conditions of an engineer; from the mechanical condition of an engine, I do.

I said that I found two and one thirty-seconds inches clearance on engine 664 between the latch and injector steam pipe. That measurement was made with the lever up against the stop block, in full forward motion. I don't recall how far the stop block was from the end of the quadrant. I would say that they would vary between two and three inches, that is, two and a half and three inches. If the stock block were sheared off, I would not say that the lever would come against the injector pipe because I never saw one sheared off. If the stop block is gone, it would go down to the end of the quadrant. If the injector steam pipe was directly behind the lever it might hit it. That is not where it was on these engines. It was approximately an inch to one side. It was right in that measurement. It was far enough to one side that if the lever had gone on down it would not have struck the injector steam pipe. If a man had his hand in there, I don't believe it would have caught that.

"Q. You said you could move the stop block back in order to give as much clearance as five or six inches altogether? Is that what your testimony was?

"A. Lengthen it out."

That would have the same effect as extending it back. That is a practical matter. That would affect the travel of your valve if you restricted the movement of the lever to that extent. It wouldn't choke the engine, because I wouldn't let it. My reach rod would take

care of that condition. If you lengthen your reach rod that would not have any effect when you reverse the engine. It would not carry your links back with the reach rod lengthened more than it should be. It would not carry your links as far back as it did be-
1039 fore you lengthened it. I would lengthen it regardless of that.

On this engine no. 664, the quadrant sets back of the boiler head. The reverse lever does not go to the side of the boiler at all. Engine 664 was equipped with a Chicago nonlifting injector. The steam pipe connection is on top of the injector. The intake pipe from the tank, the feed pipe, connects on the back side of the injector.

I spoke of the condition of the manual reverse lever being kept up at this date much better than they formerly were. We formerly did not pay as much attention to any wearing parts as we do now. That improvement has not been made effective since I have been made master mechanic. I have only been on this job since the 15th of this month. The most marked improvement has taken effect, I would say, in the last four or five years; that is, it started to show up more in the last four or five years, and it is getting better all of the time. I have never done any inspecting as an assistant master mechanic because I have just been put on the job, but it is a part of the duty of an assistant master mechanic to inspect engines.

I spoke about different parts of the power reverse and the different points [parts] becoming defective and interfering with the operation. That would affect the operation of the power reverse to more of a damaging extent with the engine in motion in making the gear creep or float. In my opinion, with the floating reverse gear, it would cause a greater consumption of fuel. In my opinion, it would create a dangerous condition due to the excess strain on the link motion. It would create a dangerous condition to a person if some of the different parts would break (tes., pp. 3660–3670).

Changing the stop on the reverse lever would cost approxi-
mately 50 cents. A piece of flat bar iron three-eighths of an inch thick or a half an inch thick and two inches wide and about
1040 four inches long would be required to do that. The average mechanic ought to do that job in twenty to twenty-five minutes. Some of the stop blocks are put on by fastening this strip of iron around the outside of the quadrant. On some of them, the large bolt on the end of the quadrant is inserted through them. There are some stops that have a hole drilled through the quadrant and the pin goes through the quadrant, but there are very few. Most of them have a U-piece around the quadrant with a bolt on the bottom or the bolt in the end of the quadrant goes through the stop, making a close fitting job.

The Alco gear was applied to engine no. 664 in the regular course of our shopping program.

(Witness excused.)

W. G. DICKHAUT, age 49, of Watertown, N.Y., employed by the New York Central, testified:

DIRECT EXAMINATION

I was first employed by the New York Central April 7, 1899, as fireman. I was promoted March 22, 1904. I have had experience with both hand and power reverse gears. I first operated a power reverse about the year 1915. Since that time, I would figure the time I have operated hand reverse and the time I have operated the power reverse would be close to fifty-fifty.

I have never had any trouble in handling the hand reverse. I have never been injured and have never seen anyone injured with the hand reverse. I have had the hand lever jump out of the quadrant of its own accord, perhaps along in 1910. The cause of that was smooth teeth in the quadrant. We do not have the same type of quadrant now. It was changed, I would think, along in 1913. Since the quadrant was changed I have never had a hand lever jump out of the quadrant of its own accord. I have never had a
1041 hand reverse lever get away from me while I was operating it or handling it; or thresh to and fro over center.

I have been in all services. I have operated the Franklin and Alco power reverse. I had an injury from a Franklin power reverse April 13, 1928, at Keenes, N.Y. I was going up and had a passenger train and a couple of extra cars. It was up-hill and right on a curve, the hardest part of the draw that we have on the road. I had to stop. When I got the signal to go I gave the engine steam but she would not start up. It was up to me to take slack. She had the wheel reverse. And at the center I had noticed that passing over the center she would catch. When I started to take the slack I saw the slack was going to run away from me a little more than I figured, and I went after that wheel, and when she came to go over the center something seemed to catch me in the shoulder. I got her out of that and continued the trip. The next morning I was not able to get a shirt on and I had to report to lay off. I was off duty three weeks. The extent of that injury was a sprained shoulder. I was paid $100 by the company. It was not necessary for me to go to the hospital. I did not have to pay the doctor's expenses because I went to a company doctor. I know that particular Franklin Precision gear was not operating all right previous to that time. They corrected it and made it all right by changing the gear. They took the whole gear off and put on the same style of gear down at Solvay engine house, New York. I had had this engine on previous trips and the gear worked hard on those trips in the same way. I had been reporting it a good many times.

If you hook up a hand reverse gear it will stay where you hook it up. If you hook up a power reverse, I don't know whether it will stay where you put it. They creep. I cannot say that I ever noticed

the Franklin gear creep. I was referring to the Alco gear mostly.

1042 I figure the effect creeping has upon my ability to handle a passenger train smoothly is the jerking and rough handling. The creeping has an effect on economy. We will say she creeps back; she is coming up to her cut-off, and you go to let her down where she is making the stroke, and she is probably behind on the stroke or carrying down, and she will go further than you want her to. She may have her pressure on the backward stroke when you come to get her out of there and then she is away back again. There is more consumption of fuel and water when it creeps than when it does not.

CROSS-EXAMINATION

I have never made a test or observation to see how much greater water and fuel consumption there is when the gear is creeping than when it is not. I have never been called in by the officials for the rough handling of a train on account of the power reverse creeping. I have never been criticized for the rough handling of my train except on freight trains, but that was not caused by handling the power reverse (tes., pp. 3670–3685).

(Witness excused.)

June 29, 1931

JESSE TRAYLOR, of Corbin, Ky., age 53, weight 195 pounds, employed by the Louisville & Nashville Railroad as traveling engineer, testified:

DIRECT EXAMINATION

I have been a traveling engineer for the Louisville & Nashville Railroad approximately 15 years. I have had ten years' experience as locomotive engineer, about four years as fireman, and three years in machine shop, all for the Louisville & Nashville. My duties as a traveling engineer are to instruct the engineers and firemen in the

1043 proper performance of their duties and the economical use of fuels and oils; and to attend investigations of accidents and engine failures. About 75 percent of my time is spent in riding and inspecting engines and in supervising the work of, and instructing engineers in the performance of, their duties. The territory I cover is from Cincinnati, Ohio, to Atlanta, Ga.; from Lebanon Junction, Ky., to Norton, Va., including the Kentucky division, Lebanon branch, Cumberland Valley division, Knoxville and Atlanta division. The character of the territory is rolling and mountainous. During the ten years I operated a locomotive as an engineer I ran on the Lebanon branch and Kentucky division of the Louisville & Nashville. The country through which those divisions run is rolling and mountainous.

While serving as locomotive engineer, I was engaged in freight and passenger service and about a year yard service all told. In freight service I operated engines from around 109,000 to 236,000, and in passenger service from 8-wheel, 18-inch engines up to about 145,000 pounds on drivers. Those engines were equipped with manual reverse gear. During my experience as a locomotive engineer for a period of ten years operating engines in both freight and passenger service, through mountainous, rolling country, and in yard service, I have operated manual reverse gear under all conditions which usually arise in the operation of a locomotive. I have never been injured by or in the operation of a manual reverse gear and have never experienced any difficulty in operating such gear. It was never necessary for the fireman or anyone to assist me in reversing or operating a manual reverse and they have never assisted me in operating or reversing such gear. My physical condition at the end of a day's work during which I operated an engine equipped with the manual reverse was good. That applies to all classes of service in which I was engaged and to all classes of engines which I have operated. The operation of a manual reverse has never prevented me from fully performing a proper lookout and other duties required of an engineer.

1044

I have never had a reverse lever get away from me and move to the corner of the quadrant. I have never experienced any difficulty in moving a reverse gear from one position on the quadrant to another. I have never had or seen the reverse lever of a manual reverse gear, whether in proper condition or not, move, from any cause, from one position on the quadrant to another, without first being unlatched by someone.

It is the duty of the engineer in charge to keep all valves and other parts of the engine properly lubricated and greased. If the lever gets away from the engineer because of improper lubrication, the fault is with the engineer and not with the reverse lever itself. That is true under all conditions. As to whether there has never been anything wrong with the lubricator, lubricator pipes, or anything of that sort, the pipes could go wrong, but ordinarily it is the engineer's duty to find out whether that lubricator is working right or not. There could be a defect. Whether the engineer is responsible for the defect depends on the nature of it. He might be. He might have a leak in the oil pipe leading down to the cylinder of the valve, which he could stop with a monkey-wrench, and he would be responsible for that, because that would prevent the oil from going to the proper place. He would be responsible for choke plugs stopped up. He can make repairs to that on the line of road. He would know that the choke plug was stopped up because the oil would not be going out of the sight feed glass. The oil goes up through the glass.

If the notches on the quadrant, the reverse lever latch and spring are maintained in proper condition, it is not possible for the lever

to move from the position in which it is placed by the engineer.
1045 If it does move, it is because of improper maintenance and not because the quadrant or its accessories are unsafe. I have seen someone injured by a manual reverse. I have never seen an engineer in what appeared to be a state or condition of exhaustion after completing a day's work on an engine equipped with a manual reverse gear. The engineer operating an engine equipped with a manual reverse gear had sufficient time to perform all lookout and other duties required of him. I have never seen or heard the engineer on any of the engines on which I was riding call for assistance in reversing the engine or moving the reverse lever. I have never seen a reverse lever get away from an engineer while attempting to move it from one position to the other (tes., pp. 3686–3696).

I am familiar with power reverse. I have not operated such gear as a locomotive engineer. I have had experience with power reverse ever since they have been on our line, since about 1915, we began experimenting. The time required to reverse an engine equipped with a manual gear is about one and a half seconds, and for an engine equipped with power reverse it is about 3½ to 4 seconds. Any of the power reverse will work about the same. The Alco is the one we have the most of. We have some Precision. That difference in time is because it takes that time for the air to pass through the ports in the control valve. There is no appliance of that kind connected with the manual reverse.

The power reverse, in my opinion, has not been perfected. As to what appliance on the locomotive has been perfected, there are several of them on there that I think are about all right; steam gauges and the throttle and brake valves, and things of that nature are about all right I think. I think they have been perfected to a much better degree than the reverse lever. By "perfected", I mean a thing that will work and do what it is supposed to do. The objection to power reverse gear is the creeping, not staying
1046 where the cut-off is desired to be. That objection does not exist with the manual reverse. I think the manual reverse gear is the safest for the engineer and for the men around the railroad shops whose duty it is to work on or about engines. I consider the manual safer because it will stay in the latch it is placed in, when they are in proper condition. Creeping causes the engine to burn some more fuel and undesirable slack action in the train at times.

As to whether I have seen any accident on the Louisville & Nashville resulting from the power reverse creeping or unexpectedly moving, on one occasion in the Cincinnati terminal, Pennsylvania station, the passenger engine on no. 33, while the engineer was oiling around, the fireman sitting on the left seat box, and I was standing within two feet of the engineer, the valve motion moved. We immediately investigated and the reverse bar was standing in the center, and the fireman said he did not move it. I do not call that an accident.

I have been present when an engine went through the wall of the roundhouse. I was present at the time of the accident and during the investigation. I saw the engine go through the wall. I heard the noise and looked around and it went over. As to what caused it to go through the wall, from what I know of the valve gear the reverse piston had moved in the cylinder of the air reverse, which actuates the link block in the link. It had not responded. The reverse gear was back of center two or three inches, and the link block was down below the center of the link. The link block was in forward motion and the reverse bar in back motion. I got into the cab ten to fifteen seconds after the engine stopped. I found the reverse bar back of center, about two or three inches, and we investigated the link block and it was below the center of the link. The air pressure had not been pumped up. We had about 30 pounds of air when I got upon the engine (tes., pp. 3696–3712).

1047 The Louisville & Nashville first applied power reverse in 1915, one manufactured by our mechanical engineer, Mr. Cox, operated with an air motor. I believe we called it the Cox gear, on account of Mr. Cox designing it. That gear would not stay put. It would go from one motion to the other. It works to the center. The air part of it, it took about a 9½ pump to keep that air reverse going. If we coupled on to any cars, we did not have enough air to run the motor on the reverse gear and take care of the air on the cars. Around 1918 the Administration gave us some locomotives with Ragonnet and Lewis valve gear. They were on when we got the Alco. We had a Brown reverse gear in there too. The Ragonnet and Lewis gear creeped to the extent that we later put the Alco control valve on all of our air reverse. As to our experience with the Brown gear, that was the reverse gear that stripped the engine backing down Corbin Hill.

"Q. Has it abandoned the use of those, each of those four gears?

"A. That was the cause of us abandoning the control value [valve] on the Brown reverse gear."

It is now using the Alco. The Alco gear creeps but not as bad as the other types. We are using the E type Alco gear now, which is the latest type of Alco gear, and I think most all of our control valves are E type, because of that situation. The engines came from the factory equipped with gears of that kind when the Louisville & Nashville purchased them, with the exception of the ones I mentioned. We put that Alco control valve on all valve gears that we now have except the one made by Mr. Cox, which has no reverse cylinder. As to when they last purchased engines equipped with Alco reverse, we purchased six engines in December. Five of them were delivered to us in December 1930, and one in January, about the 10th of January, equipped with the latest type of Alco reverse

1048 gear. We have instruction relative to the use of gears on those six engines. We have written instructions to our locomotive engineers handling that type of engines not to cut them back of 20 per cent cut-off. We have the reverse quadrant numbered at the

different cut-offs and marked, filed in the quadrant at that point, so that the man can very easily locate the point at night without moving and taking his attention from his view ahead. The purpose of that regulation is to prevent that working back to center and blanking the valve port. The gear on each of those engines I have described creeps.

CROSS-EXAMINATION

I have never had any trouble with the manual reverse gear. I said that I have observed other engineers operating it and that in my observation I had never seen them have any difficulty. At no time in my experience as a railroad engineman or hostler have I seen anyone have any difficulty with a manual reverse bar when in good condition. I have not seen them have any difficulty with it when it was not in good condition. I never saw anybody have any trouble with a manual reverse gear, whether it was in good condition or not. I would not say that we maintained the manual reverse gear in better condition than we do the balance of the locomotive.

The territory over which I have jurisdiction as traveling engineer is from Cincinnati, Ohio, to Atlanta, Ga. That is the Kentucky division, the Lebanon branch, Cumberland Valley division, Knoxville division and Atlanta division. I would imagine I have supervision over roundabout 400 engineers. Just now, I would have to count them, but that is normal. There are two to three hundred engines ordinarily housed in my territory. As to whether it is my duty to keep familiar with the condition of the engines as to the maintenance of the reversing gear, I am riding about 75 per cent of the time on as many as I can get on. I have never observed
1049 the lever work out of the quadrant on any of those locomotives and go down a notch or two. I have observed the lever work in the notches of the quadrant back and forth; that is the way we tell when our valves are getting dry. We all ride with our hands on the reverse bar, or at least we do with the old reverse bar. I never had any trouble at all with the notches in the quadrant being worn at the top and tapered. I have observed the latch on the bar where it fits against the dog, or fits against the notches, to be worn a little, but when you work the bar you feel it work. If they were tight, they would stick in the latch. I have never observed that latch working out of the notches. It does not have any tendency to work out. I never had any experience with them working out.

As to how I brace myself when I handle the manual reverse bar when I am going along at high speed and want to hook it up or drop down a notch, I take one hand, undo the latch, and hold the bar with one hand, and get my foot against the brace and get hold of the bar before attempting to move it. We all have a brace in front of the quadrant. I put this foot on it [indicating]. I have done that when I have dry valves. There would be more pull on

the lever with a dry valve, and when a man knows his valves are dry, he knows how to handle the throttle. He eases down on the throttle before making a reverse bar adjustment. You do that to keep the strain off the bar while you are making the adjustment. As to whether, in my judgment, it is necessary to take that strain off the bar by adjusting my throttle before I handle the lever, I always do that for precaution against moving the bar. I would not want to strain myself with the bar, with a dry valve. If I had dry valves, I would ease up on the throttle and brace myself.

I would not reverse the engine with steam in the cylinders because it is harder to handle with steam. I am working
1050 against the steam pressure. I would open the cylinder cocks and let the steam out. I might be able to throw the lever over with the cylinders full of steam, but it would be harder to do. I know how to take care of myself in a case of that kind, by getting the steam out of the cylinders. I do not think it is a dangerous thing to handle the lever with steam in the cylinders. As to whether it is a safe practice to do that, I do not know whether there is any danger in it. If you want to do that much extra work, all right, but I want to get out of all the extra work I can when reversing an engine. That is the only reason, to save the strain in handling the bar, with steam in the cylinders. It is possible at all times to drain the cylinders of steam. I have always done it.

"Q. You have never handled the lever when it was not possible to drain the cylinders of the steam?

"A. There is no necessity of it, when you can open the cylinder cocks."

The cylinder cocks will always open. I mean by that that I have never had a cylinder cock I could not open when I wanted to. I have never been in a position where I could not open the cylinder cocks. I have never had an engine on a street crossing when the cylinders were full of steam; never stopped on street crossing. We are down in the mountains. I have had five years local work. In that length of time I never had occasion to have steam in the cylinders on a street crossing which would interfere with anything. I have had to take slack with a passenger train at a station. As to whether that is a rapid movement, you can take your time about it or you can be in a hurry.

"Q. Do you take as much time as you want to?

"A. It don't take very long to take the slack; no, sir."

As to what operations of the reverse lever I perform to take the slack, I pull the engine in back motion if I try to
1051 start the train and it stalled. When you get the engine in back motion, you do not have to throw it forward again. As to whether that is a rapid movement, if you have to throw it in forward motion you do not have to be in a hurry because you generally take the slack by air. The slack won't run out if you do not hurry up, if you take it by air, set your brake—I mean when you take the slack. I am able to empty my cylinders of steam under those cir-

cumstances. Nobody is standing around where you cannot open these cocks; we do not have any trouble with that. Our cylinder cocks all blow under the engine anyway. I open them when there are people around. It would not hurt anybody (tes., pp. 3712–3724).

I never handled a lever with the counter-balance spring out of adjustment, but I know of cases where they have broken a counter-balance spring. If they were not right, I had them fixed before leaving the roundhouse. As to how I would know it was not right, I would try them out. I have operated them when they were not right on engines coming out of the shop, not properly adjusted. I have never had any difficulty handling the levers on those engines with the counter-balance spring out of adjustment. I had them fixed before leaving the roundhouse. The lever was hard to operate before getting the counter-balance spring adjusted. We were inspecting them to find out what the condition was. If the counter-balance spring was not right the lever would operate with difficulty, but we had it right before we left.

I never had any experience with the link block binding. We have had cases where they would be put up too tight, and we would take them down and fix them. The Johnson bar would handle with difficulty if the link blocks were put up too tight. I have never had any trouble with that. I have never had a link block put up too tightly. We have good mechanics. I do not think I ever had an engine which I operated where the link block was tight. I do not know that
1052 I have ever ridden on any engines where the link block was put up tightly.

"Q. Have you ever had any engineer complain to you that the link block or any part of the link motion was tight?

"A. I have had engineers complain about engines handling rough, and we would investigate it and remedy the trouble."

We found in some cases the counterbalance spring weak. No trouble with tight bearings or bushings. With an engine new out of the shop, sometimes the bearings were tight. Any engine out of the shop, it will work a little hard the first round trip. I have had complaints about new engines, but not so much because everybody expects a new engine to work a little hard.

I have never handled an engine where the rings were broken in the ports. As to whether rings broken in the ports would cause the lever to work hard, if the rings stuck in the port they would tear the valve gear off, I imagine. You would have one revolution and then have no trouble with them. If I were handling the lever when that happened, I do not know what would take place. In my judgment, if you put something in the port the reverse bar would handle rough in a case like that. I think the latch would hold sufficient although it took the valve motion off. I think the lever would stay in the quadrant if the latch was all right and was not worn. I have never seen a case where it was not all right.

A choke plug is at the back of the lubricator to prevent the steam pressure from stopping the flow of oil down to the delivery pipe.

It is back behind the lubricator, where the oil pipe fits on. As to whether they are all located there, the Detroit lubricator has it at the delivery end of the tallow pipe. The one at the top of the steam chest is the one I am talking about. If that became stopped up, the engineer would be advised of difficulty when his engine
1053 gets dry. He could not tell until the engine began to get dry, on that particular type. It will feed out of the sight-feed glass. It is easy to remedy that after discovering it. Just run a small wire into the choke plug. He could not do that running along, but would have to stop. If the one which screws into the feed part of the lubricator became stopped up, he would open up the turret, and that would flow through. As to whether that would always clear it out, in all the cases I have had experience with it did. In both of those instances the valves get dry before you discover it, generally, and that tells where the trouble is at. With the choke in the back, you could see the oil accumulating in the sight-feed glass first. The engineer is not responsible for the choke plug getting stopped up, which prevents proper lubrication of the valve. An engineer is not responsible for the leaky dry pipe, which causes dry valves. Whether an engineer is responsible for a strip breaking in the valve depends on what causes the strip to break in the valve. We have the slide valve, but do not have any strip but have a round cap. I do not know whether an engineer would be responsible or not when the choke plug stops up, causing the valves to become dry and causing thereby the broken rings. He is responsible if the latch of the quadrant becomes worn. He might be responsible if the stud breaks off and lets the quadrant down. He might have worked too much water and caused the engine to pull that off. If he works too much water that will pull the stud off, lets the valve get dry. As to what would become of the reverse lever if it got in that condition and pulled away from the quadrant, the stud might break off when the notches were all right. If that should cause the reverse lever to move without lifting it out of the quadrant, I suppose it would go in the direction in which you were working the engine. As to whether the lever would jump out of the quadrant without [un]latching the notch, I have never seen them. If
1054 that would happen the engineer might be responsible for dry valves. If the reverse lever comes out of the latch, it would go to the corner. It will come out of the latch if the quadrant comes down. The engineer does not have to squeeze the latch rod to have it do that in that case.

If a latch would get worn on a piston-valve engine, I do not know whether it would tear the valve gear up; I never had that happen to me.

"Q. Did you not make that statement in reply to Mr. McLaughlin?

"A. I never had it happen to me" (tes., pp. 3724–3734).

I think the manual mechanism has been perfected.

When this engine went through the roundhouse wall because the air was not pumped up sufficiently to reverse the gear, I was talking

to the roundhouse foreman, within 40 feet of the engine. When I heard it go through the wall I ran down to see what the trouble was. I met the hostler within 20 feet of the engine and we got up on the engine to see what the trouble was. I made a statement that I got in the engine cab within 15 seconds after it happened. I was 40 feet from there.

"Q. Did you ever see an engine go through the roundhouse wall when equipped with power reverse?

"A. No, sir; I do not recall.

"Q. That was not equipped with power reverse?

"A. No, sir.

"Q. Did you ever see one equipped with power reverse go through the roundhouse?

"A. Yes, sir.

"Q. You saw that occasion?

"A. Yes, sir" (tr. 3736–3737).

We have safety instructions or campaigns on the Louisville & Nashville. I am associated with those safety meetings. It is a part of my duty to attend the safety meetings. Their purpose is to bring about a safer working condition for the men, instruct them how to take care of themselves and handle the equipment without being injured. If we find unsafe conditions, we bring them up in our safety meetings. I do not remember ever having the question of air reverse up at safety meetings. We did not bring that up
1055 because we handle that officially with our mechanical men, where we can get action. We can get action without handling it through the safety meetings. As to whether I do not think it is of sufficient importance to warn our engineers of the dangers of air reverse, they have been warned many times personally but not at safety meetings. I have warned most everyone we have got about the dangers of power reverse. I have warned hostlers about handling them in roundhouses. I have told our engineers nothing except to watch out for them when oiling around, that the reverse gear is liable to creep on them, and to keep their hands in a position where they can get out of the way when that occurs. I have seen that occur to an engine, and nobody injured. I have never seen an engineer hurt by the movement of the mechanism without anybody operating it. Any moving part of the engine is likely to injure a man if it is in motion and he comes in contact with it.

I have talked to the mechanical department many times about the dangers of power reverse. I do not think I have ever made a written report on it. We handled the thing direct with the master mechanic. The master mechanics are not the officials that have the jurisdiction to say what kind of equipment shall be on the locomotives. The superintendent of machinery decides that. I have informed him of the dangers of air reverse in such a manner that we have got the Lewis and Ragonnet and Brown gear changed to Alco control valve. That is how much? An Alco is unsafe in that it creeps; liable to

move when you are not expecting it. I have informed the superintendent of machinery of that fact. I have not recommended that it be taken off because we are trying to protect the thing. We would like to have it perfect.

"Q. At the risk of the lives and limbs of your engineers?

"A. Like the rest of the locomotive."

Knowing they are dangerous, we leave them on and try to perfect them. The Cox was the first I named. Something
1056 like 30 or 40 of those were equipped on locomotives. I do not recall just how many. They are on yet, on switch engines. The Ragonnet was next. We put on 15 of those, I believe. Most all of them are off. There may be one or two of them on yet, but most of them have been taken off and replaced with the Alco. I spoke of a Brown. We had about five of those. They were abandoned because we used the Alco control valve. We have 15 or 20 of this cock [Cox] I spoke of. I do not know just what the number is, because they are not all in my territory. The danger of that type is that it is liable to do just what the other type did, and liable to work back in the other position, but we have never used them in pusher service, but straight switching, either forward or backward motion. We have never had anybody hurt with one but they are dangerous; anything is dangerous which won't stay where it is put, in the way of a reverse gear. When the throttle is in good condition it will stay where it is put. I do not know if it would stay where it is put under any conditions.

I said it takes three and a half seconds to reverse the Alco power reverse. I mean by that to move the lever from the front corner to the front or vice versa. That is on the latest type. I actually timed that with a stop watch through about eight or ten operations, and we got the average as three and a half to four seconds. That was the approximate average.

REDIRECT EXAMINATION

I mean it takes three to four seconds to shift that lever on a power reverse from extreme forward to extreme backward position.

"Q. Or when the thing is actually reversing?

"A. Some of the time the lever would move that much in the operation; yes, sir."

The machine comes along with the movement of the lever. It takes you that long to shift that lever because of the flow of air
1057 through the ports in the control valve. You cannot move that lever any faster than the air flows through the ports.

If the choke plugs become stopped up on an engine that is in service and are permitted to remain stopped up it is the engineer's fault. It would not be the engineer's fault from the time he first discovers the choke plugs stopped up until he gets over to where he could stop with safety.

In my experience, valves on an engine very seldom become dry on account of lack of lubrication.

I tested the movement of the power reverse with the latest type Alco. I did not make any test with the Barco or Franklin (tes., pp. 3734–3745).

(Witness excused.)

O. G. McPHAIL, of Louisville, Ky., age 57, employed by the Louisville & Nashville as fuel supervisor, testified:

DIRECT EXAMINATION

I look after the use of fuel and the inspection of locomotives for the Louisville & Nashville. I have been a fuel supervisor and inspector of locomotives approximately four years. As to my other railroad experience, I served my time as a machinist, and fired about four months; and then I ran an engine on the Southern Railway out of Atlanta for about six years. I left the service of the Southern and went to the Seaboard at Savannah, Ga., as roundhouse foreman, remaining there about a year or fourteen months, and then left the service of the Seaboard and came to Columbus, Ga., with the Central of Georgia, as air brake man and machinist. I left this job and went as master mechanic for a road in Albany, Ga., a joint job for the Albany Northern, Georgia Northern, and Seaboard, remaining there approximately four years. I left that service and went back to the Central of Georgia, to enter engine
1058 service. Remained on the Central of Georgia about 6 years. Left the Central of Georgia and went to the A., B. & A. as locomotive engineer about 1912 or 1913. Made four trips and was asked to take the job as roundhouse foreman. I remained on this job about four months and was made general foreman, and from general foreman to master mechanic, and remained with the A., B. & A. as master mechanic between three and a half and four years. I left the service of the A., B. & A. and got service with the Cumberland & Manchester, running from Barberville to Manchester, connecting with the Louisville & Nashville at Heidrick, remaining with that road as master mechanic until about 1927, when it was bought by the Louisville & Nashville; and I was given the position of fuel supervisor on the Louisville & Nashville on the absorption of that road.

As fuel supervisor and inspector of locomotives my duties are to see that the quality of the fuel is kept up to a specification or standard, and instruct the men on proper firing and handling the engines, the inspection of locomotives, particularly insofar as the front end, grate bars, valve motion, and its parts are concerned. The first three years I spent approximately 75 percent of my time on locomotives in the roundshops. I am speaking now of my duties as a fuel inspector and inspector of locomotives. About 25 percent of my time is now spent in that kind of work. The other 75 percent

is spent in the office, having other duties assigned to me by the superintendent of machinery.

I was actually operating an engine about ten years. I was in both freight and passenger service during that time and had about four months experience in yard service. I am familiar with the manual and power reverse gears. I would say when I was acting as an engineer that I operated a manual reverse gear 75 to 80 percent of the time. The remaining portion I operated a power reverse. I was never injured in the operation of a manual re-
1059 verse gear. No one was ever injured in the operation of a manual reverse gear on an engine on which I was riding. In my judgment a manual reverse gear is a safe instrument with which to work. If a manual reverse gear is in proper condition and the engineer places himself in a proper position to operate it, there is no danger whatever to the engineer or to anyone in its operation, in my opinion. A manual reverse gear that is in proper condition and properly lubricated is not difficult to operate. The parts have been put up close or I will say lack of lubrication is the trouble with the gear if the assistance of the fireman is necessary at times in operating a manual reverse gear. As to what leads me to that conclusion, I have handled engines just out of the shops, newly overhauled, and also have handled engines with dry valves. The lever was harder to handle at the beginning of the trip. I know that dry valves would make the engine run hard because I have run engines with dry valves and have had them run hard. In case I have an engine with dry valves, I usually overcome that trouble by increasing the amount of oil to the cylinders and the valve, and easing off on your throttle, reducing the steam pressure.

I have always had ample time and opportunity while operating a manual reverse to perform all lookout and other duties. At the beginning of this service, I spent 75 percent of my time on the locomotives in operation and around the shop, and I will say there was 40 percent of that time when I was riding the locomotive. When I am in the cab, riding with the engineer, he is within the line of my vision, on most all classes of engines. Sometimes I am on the left-hand side and other times I am on the right side. It has been my observation while riding on engines that are being operated by other engineers, that the engineer in such cases has sufficient time to perform all lookout and other duties.

It has been necessary for the fireman to assist me in hooking up or reversing an engine. That was on account of the link
1060 motion and other parts being set up snugly, after the engine was newly overhauled. That is the exception.

I know of power reverse gears which creep. I have handled two different types of power reverse gear, and both would creep at times, making it impossible for an engineer to be in charge or control the cut-off of your valve at the desired point. Those types were the Ragonnet and the Alco. In my experience, sometimes the valve has

creeped as much as 15 percent. That would be three inches in the extreme. I have had the power reverse gear to creep from the forward to the center or reverse position when my engine was at high speed. At high speed the effect on the train or the engine is very noticeable. Last year I was riding our engine no. 1815, to the best of my recollection, between Bowling Green and Louisville. Engineer Lindsey was operating the locomotive. We were running at a rapid rate of speed, and he had the engine or the valves cut back close to the center. She was running very smoothly, but in a second the engine began to pound through the rods and boxes, and the exhaust was irregular. I jumped over to the right side to move the lever forward, but Lindsey beat me to it. He knew what happened. And as soon as the lever was moved, the pounding ceased. I have had the gears to creep very often, and change the cut-off without any warning. She would drop herself down and very shortly the valve would move, and she would hook herself back up. I have not had a case of that kind of instance in which any damage resulted in road service (tes., pp. 3745–3756).

In my experience, I have had a failure of a power reverse. I had a piston to break off in the key-way, where it was screwed to the cross-head of the valve gear. This was a power reverse itself. The
1061 train was in motion. I stopped the train and put out a flag, and cut the block, to work the engine at a proper cut-off to get to the terminal. As to whether that same thing would have happened if the engine had been equipped with a manual reverse, there would not have been any piston or cross-head on the manual reverse. As to the effect upon the operation of the train in breaking this pin which I spoke of, the valve was allowed to shift further forward, admitting more steam to the cylinders suddenly, more than should have been admitted at the speed we were running, causing a jerk on the train.

I have never known of a manual reverse lever flying back and forth in the quadrant. In my opinion, that would not happen when the quadrant, lever, latch, and latch spring are in proper condition and properly lubricated. If the engine is running at high speed and the valves become dry, the engineer on a manual reverse engine can detect that fact by a different sound of the lever. In other words, the chattering is more noticeable. He can discover that fact by taking hold of the lever, and by ear also, as a rule.

As to whether I have ever seen anyone injured in or by the operation of a power reverse, I was oiling an engine around on an adjacent track to where another engineer was oiling, and I heard him make an explanation [exclamation], holler. I turned and looked, and he had dropped his oil can on the ground near the engine he was oiling around. I stepped over and saw a man's arm broken, and afterwards learned it was broken in two places. The engineer stated to me that the radius bar moved while he had his arm between the radius bar and the guide of the valve crosshead, oiling the front

shoe and wedges on the right side. I do not personally know whether there have been any accidents of any kind around shops or roundhouses with engines equipped with power reverse.

CROSS-EXAMINATION

The engineer told me when I was talking to him after the accident that the radius rod had dropped on his arm.

1062 The piston rod broke off in the keyway on this power-reverse. That let the valves go in forward motion. If the bolt in the front end of the reach rod had come out of the tumbling shaft, that would have had the same effect with a manually operated engine. I blocked the crosshead of the power reverse and proceeded with my train. As to whether the lever in the cab moved at all or remained stationary, it set right there. No one was injured in that case.

As a rule we use the reverse bar as an indicator for dry valves. That is among the first indications we get of dry valves, as an engineer. It is not the first at all times. With a long blade engine, the valves will begin to do what they call squeak. The reverse bar will chatter from other causes than dry valves.

(Witness excused.)

L. W. PULLIAM, of Louisville, Ky., age 58, weight 197, employed by the Louisville & Nashville Railroad as traveling engineer, testified:

DIRECT EXAMINATION

I have been traveling engineer on the Louisville & Nashville for 21 years. I began firing in 1898, October 19th, and I fired until April 14, 1893, when I was promoted to engineer. I was a locomotive engineer from April 1893 until September 10, 1910, when I was promoted to traveling engineer. As a traveling engineer, I have general supervision over the engineers and firemen on my territory. I also check up all locomotives that I ride for defects and report the same to the master mechanic or the superintendent of machinery, if I consider it necessary; I am on the fuel committee and on the safety committee and smoke abatement committee; I am a member of the tonnage rating committee; that is, the inspector of transportation and myself; and I am on the mechanical com-

1063 mittee that examines the firemen for promotion to engineer, and any other duties that the superintendent of machinery assigns to me. I would judge about 75 percent of my time is spent in riding and inspecting engines and in supervising and instructing engineers in the performance of their duties. I cover the L. C. & L. division, including the Lexington branch, the main first division and the main second division, the Memphis line, the C division and the Memphis division, and the Louisville terminal. The northern division is hilly and the next two-named divisions are rolling (tes., pp. 3756–3767).

I worked as an engineer on the Lebanon branch and the Knoxville division, in freight service and extra passenger service. All of the engines that I operated while an engineer were hand reverse levers. None of the engines that I operated as an engineer were equipped with power reverse. I am familiar with the operations of the power reverse gear. The engineer or anyone on any of the trains on which I was riding have not been injured to any extent by the operation of a manual reverse to my knowledge. I was never injured by or in the operation of a manual reverse. In my experience, it was necessary for the fireman to assist the engineer in reversing a manual reverse gear only in the case of a new engine out of the shop. That was necessary in that case because the parts were all put up snug and not lubricated. Ordinarily it takes the engine one break-in trip to limber up so that such assistance is not necessary.

The proper position for the engineer to take in hooking up and in reversing with the manual reverse is sitting on the seat box and reach over and take hold of the lever with one hand and unlatch the lever with the other hand and pull it back; that is, in hooking it up. If the engine is hard to reverse and the engineer takes the proper position as I have described it, there is no danger of injury in reversing the engine. I have never known of the lever of the manual reverse gear moving back and forth in the quadrant without first being unlatched.

1064 I have handled the power-reverse a good deal since the management began to install it, in instructing engineers as to the operation of the locomotive or in making tonnage tests. All of the different kinds of gears with which I have had experience creep. They do not creep all of the time. On one occasion I had an accident or near-accident caused by the gear creeping. On the Pan American, one of our fast passenger trains, on running track with the reverse lever hooked up close and working a light throttle the reverse crept or centered, that is, the valve did over the port, and the engine made an awful racket, like it was going to tear itself up. I jumped over by the engineer and dropped the lever down, and that stopped it. That is the only experience of that kind that I ever had. I could not distinguish from the way the engine sounded from the pounding and kicking whether that gear crept in reverse or only to center. In my judgment, if I had not changed this lever quick the engine would have stripped itself.

If the manual reverse is in first-class working condition and the power reverse is also in first-class working condition, the manual will reverse the engine more quickly than the power reverse. That is because it just takes the time until you can get hold of the lever until you can throw it into back or forward motion with your hand, which is a very quick movement. With the power reverse from the time you move the lever you have to wait until the rotary valve actuates and the air exhausts from the cylinder on the other end from which you move it. I have made no tests as to the time required in reversing the manual and the power reverse.

The operation of the manual reverse does not prevent the engineer from keeping a proper look-out and fully performing all other duties required of him. I have never had a manual reverse
1065 break or fail, causing the lever to get out of control. That has never happened on any engines on which I was riding, either as engineer or traveling engineer. In my opinion, an engine equipped with the manual reverse in proper condition is safer for the engineer and for shop employees whose duty it is to work on or about engines than an engine equipped with the power reverse in proper condition. I say that is true because a manual reverse will stay in the position in which you set it; the power reverse creeps.

In my opinion, if at times it is difficult to move the manual reverse lever, the cause of that is valves not lubricated or some of the parts too tight. Those conditions can be remedied by feeding oil to the valves and cylinders through the lubricator, if you have dry valves. It is the engineer's duty to see that the valves are properly lubricated on an engine in service. If at times the lever moves in the quadrant from one position to another without being unlatched, in my opinion the cause of that is a worn piece in the quadrant or weak spring in the latch. I would interpret that as being the duty of the engineer to report the weak springs in the quadrant or loose latch, and the shop forces to make the repairs.

I have never been in an exhausted or overly tired condition after a day's work on an engine equipped with a manual reverse.

CROSS-EXAMINATION

I don't recall the number of the engine on the occasion I said that an engine came back beyond the center and caused a lot of knocking. It happened about eight or ten years ago, and the engineer is dead. I don't recall who the fireman was. I don't know whether he is dead or not, but I know the engineer is dead. But that actually happened. I was on the engine. As to whether it is one of the duties of the road foreman to go over and adjust the lever for the engineer, I do that sometimes, very often. I can give a reason why the engineer did not make the adjustment.
1066 A lot of our old-time runners work piston-valve engines too close and the engine will be more efficient if it is dropped down a notch or two notches. You know that. I would judge it was about a second or two seconds from the time it began to do all of this pounding until I let the engine down. I was standing in the deck right alongside of him. That wouldn't have been time enough to do the damage if it had been so serious; he was working a light throttle on high speed. I didn't say it reversed. I said it either reversed or centered itself. The number of the train that the engine was pulling was no. 98, the Pan American. It was eight or ten years ago. It was along in the latter part of the summer, to the best of my recollection. I would judge we were running 55 or 60 miles an hour when that occurred (tes., pp. 3767–3776).

I have had to get off of the seat box in order to reverse a manually operated engine. In doing that I would stand up alongside of the reverse lever. I had some difficulty in pulling her back. I could see what was going on outside in front during that operation. In switching service you have to stick your head out the side window. In switching, if you had to stand up and pull the lever over, you couldn't see until you pulled it over and stuck your head out.

When valves get dry the way to relieve that condition is to feed more oil to the valves. If an engine gets dry by the lubricator stopping after you get it started, it would take about 15 minues for the oil to reach the cylinder or the valves. But [you] overcome that trouble by giving the engine a dose of oil through the release valve. You can do that by going out on the running board. That is an emergency method of oiling. You can do that on all of our engines. As to whether, if you let the oil go through the lubricator, she continues to be rough for at least 15 minutes, it takes
1067 about 15 minutes with the hydrostatic lubricator to get from the lubricator down to the valves.

I referred to the spring being loose or the quadrant teeth being worn or the latch being worn and it was the engineer's duty to report that and that it was repaired in the shop. Everything reported by an engineer is not repaired in the shop when it is reported on the Louisville & Nashville Railroad nor on any other one. It could be possible that the engineer had reported this weak spring and it went back on the road in the same condition as reported. I have never had a reverse lever jump out of the quadrant.

The compression in the cylinder would have caused that engine to strip herself. As to whether it was my thought that the engine would reverse herself if I had not pushed her down, I think it had done it, the way it acted. I said on direct examination it either had worked in the back motion or the valve had centered itself over the port. As to whether it was my thought that if I had not corrected it it would have crept still further back over the center, my thought was to get the lever down before anything happened. As to what more I think would happen that [would] cause the engine to strip itself, running at that high speed with it in the condition in which it was at that particular movement you might feel like it was going to strip itself. I have never had the experience of an engine that stripped itself. I have never had an experience that one of these air reverses, after it had crept, would stay at the point where it had crept; it moves this way [illustrating]. Even if I had not touched it, my experience would be that generally the gear would tend to creep back to its proper place. That would have been its tendency. As to whether it would have been its tendency to correct this condition rather than aggravate it, if you will allow me to qualify that I will say with the feeling that we had we could not wait for it to do this thing. That apprehension is not
1068 just merely a remark, because with an engine pounding and

making all of the noise that it was making you would feel like the rod was going to fly through the air any minute. I have heard locomotives pound before. I have never had one strip with me. None has ever stripped on account of a creeping power reverse gear on our railroad to my knowledge. When I said I thought it would strip itself that was to give an idea of the seriousness of the pounding.

I am on the safety committee and these other committees. While I was running on the Louisville & Nashville Railroad they were all manually reversed. I became traveling engineer in 1910. I think it was 1915 or somewhere along in there when we began to get power reverse. We have been getting more and more of them during the 15 years. I have never recommended to the safety committee that they should not be put on because of the danger of them. As to why I didn't, the prerogative of installing equipment belongs to the superintendent of machinery and the management upstairs. I would feet that I would be presumptious in criticizing something that the management had decided.

"Q. Even if it were manifestly unsafe would you think that, Mr. Pulliam?

"A. I have never considered it unsafe except as related—well, I have just considered it a labor-saving device."

Power reverse is unsafe to shopmen and men oiling around when it creeps—the engine crews. Any piece of machinery would be unsafe to the men working around it when it creeps unexpectedly. That is why I think this is unsafe. If an engineer were oiling around a locomotive with a manual reverse and somebody in the cab moved it with the engineer not knowing about it, that would be unsafe to the engineer if he had his hands caught. It is in that sense that the power reverse is likely to be unsafe in an unexpected movement. As to whether it is necessary for the engineer to put himself in a position where he could be hurt in the event
1069 of an unexpected movement while oiling the locomotive, he should not do it. He could oil the front shoe or wedge or some of the parts around the valve gear without putting his arm under the radius rod (tes., pp. 3776–3787).

I have never investigated any failure of a manual reversing gear. The master mechanic does that. I couldn't say whether any of the locomotives that are under my supervision were ever ordered out of service by the Federal inspector on which the manual reversing gear was reported defective. I do not know positively about any such instances. The report of the Federal inspector is given to the master mechanic and it is sent upstairs. As to whether I have seen any that report manual reverse gears defective, I haven't seen the reports on that.

(Witness excused.)

A. E. Wood, of Nashville, Tenn., age 51, weight 168 pounds, employed by the Louisville & Nashville as traveling engineer, testified:

DIRECT EXAMINATION

I have been in the service of the Louisville & Nashville Railroad as a traveling engineer for five years. As to my other railroad experience, I have had three and a half years as a bridge carpenter, four and a half years as a locomotive fireman, twenty years as a locomotive engineer. I heard Mr. Traylor and Mr. Pulliam enumerate and describe their duties as traveling engineers for the Louisville & Nashville. The duties of all traveling engineers for the Louisville & Nashville are the same. Approximately 75 percent of my time is spent in riding and supervising engines and instructing engineers in respect of their duties. As a traveling engineer I work in the Nashville division south, the Henderson division and the St. Louis division, the Nashville terminal and East St. Louis ter-
1070 minal. The country in which those divisions are located is rolling and hilly. Practically all of my experience in running an engine was on the Nashville division south, and all of it with the exception of five months on the Henderson division in 1911. The Nashville south comprises the territory south of Nashville, between Nashville and Decatur, Ala., and Sheffield, Ala., including the Nashville and Decatur division, the Nashville, Florence and Sheffield division, and the Lewisburg division. I worked in freight service as an engineer and occasionally a passenger run. I operated all classes of engines that the company had at that time, of the small passenger engines and the largest freight engine that the Louisville & Nashville Railroad had at that time. I am familiar with both the manual reverse gear and the power reverse gear. For the first 14 years I served as an engineer I had only hand reverse gear. Since then I had both manual and power reverse gears. Seventy-five percent of that time was power reverse gear and 25 percent manual reverse gear. During my experience in the 20 years as a locomotive engineer I operated both manual and power reverse gear under all conditions which usually arise in the operation of locomotives.

I was never injured and I have never seen anyone injured by or in the operation of the manual reverse. I have never experienced any difficulty in operating such gears, only in case of a new engine out of the shop. That character of engine was a little hard to handle on account of the bearings all being new and the engines had not been broken in. Ordinarily it takes one break-in trip to break in an engine just out of the shops so that the manual reverse will work easily on it. It was never necessary for anyone to assist me and no one ever assisted me in the operation of a manual reverse. There was no difference in my physical condition at the end of a day's work during which I operated an engine equipped with the manual reverse gear and at the end of the day's work during

1071 which I operated an engine equipped with the power-reverse gear. The operation of the manual reverse does not prevent an engineer from performing all look-out duties and other duties required of him to any greater extent than the operation of an engine equipped with power reverse. In all my experience I have never experienced any difficulty in keeping a proper look-out with either the power reverse or the hand reverse.

I have never had the lever of a manual reverse get away from me and move to the corner of the quadrant. I have never had any difficulty in moving the reverse lever from one position on the quadrant to another. I have never had or seen the reverse lever of a manual reverse gear in proper condition, properly lubricated, move from one position on the quadrant to another from any cause unless it was first unlatched by somebody.

The new engine out of the shop is one cause of the reverse lever moving with difficulty, and dry valves would be another cause. The remedy for dry valves is to give the engine more oil through the lubricator. It is the duty of the engineer to do that. In my individual experience it was very seldom that the valves of the engine became dry. If the lever will at times move from one position to another without first being unlatched by someone, it might be dry valves that would cause that. If the spring was weak or if the teeth in the quadrant were worn, or if the latch was worn, it might cause it. I did not intend to state that that condition could be brought about by dry valves where the lever becomes unlatched without someone first unlatching it. The condition which I described can be remedied by proper lubrication from dry valves. The condition which I have just described, that is, of the spring being weak or the teeth, can be remedied. The engineer while operating the manual reverse has sufficient time to perform all look-out and all other duties required of him. I have never seen or heard the engineer on any of the engines on which I was riding call for assistance in reversing the engine or in moving the reverse lever.

1072 The power reverse gear, in my opinion, has not been perfected. The objection to it as now developed is the creeping. The power-reverse gear requires more attention, that is, the maintenance is more difficult and more expensive than the hand reverse, because with the hand reverse all of the parts are in full view, you can see them at any time. With the power reverse some parts of the gear you cannot inspect without partly dismantling the gear. In my opinion, the manual reverse is safer for the engineer and for those who work on or near the locomotives than an engine equipped with the power reverse, because the power reverse creeps but the manual reverse does not creep. There is an element of danger connected with the creeping of the power reverse gear. You do not have that element of danger with the manual reverse (tes., pp. 3787–3797).

As to what, in my opinion, probably would be the effect upon the engine if the reverse gear should creep into reverse or on center,

the possibilities are that you would damage the engine by stripping it. I do not personally know of any accident on the Louisville & Nashville caused from the power reverse creeping. I have seen them creep, but I never saw any accident caused by the power reverse creeping. I have seen accidents of other kinds caused by the power reverse. I personally know of two cases of engines backing into the turntable pits. I was present and saw those incidents. I know the engines backed into the pit. I was some 30 feet or 40 feet or maybe 50 feet from the turntable pit at the time. I immediately went to the place of the accident to ascertain the cause. I made an examination of the reverse gear. I found the reverse lever in back motion. There were about 30 pounds of air on the engine. You could not operate the reversing mechanism with 30 pounds of air. The links were in back motion and the lever was in back motion. The engine was in back motion. I will say the engine moved 40 feet be-
1073 fore it went into the pit. The air brakes cannot operate effectively with 30 pounds of air. I would say they would not operate at all. From the conditions which I found when I made the examination, considering the position in which I found the gears, the amount of air in the tank or reservoir, it was not possible to stop that engine before it got into the pit. If that engine had been equipped with the manual reverse, it would have been possible to stop it before it got into the pit. As to how I account for the fact that the hostler started to back that engine out without enough air to stop it, that was one of those man failures I would take it.

I know of one other case at Howell, Ind., which was a similar case. I saw the engine go into the turntable pit. The hostler was in the cab. I saw the engine back into the pit but I wasn't close enough to see what the hostler did after he got on the engine before opening the throttle. The reverse lever after it went into the pit was about two and a half or three inches past the center in back motion. That engine had at that time about 25 pounds of air pressure on it. It takes about 56 pounds of air approximately to operate the power reverse. It is necessary to have that much pressure before you can move any great distance. You may move it a short distance either forward or back of the center, but to get it in full stroke in either direction it requires that much pressure. Possibly 55 or 60 pounds would be sufficient to stop an engine with the brakes, moving as engines do out of the house that way to the turntable. Those are all the cases that I have personal knowledge of.

CROSS-EXAMINATION

Dry valves will cause hand-operated levers to work hard. And with engines new out of the shop the tightness of bearings will do it. I don't recall any other causes. If the counterbalance is improperly adjusted that may make the lever work hard. I have had that
1074 experience. I have had experience with the dry valves, the tight motion or tight blocks, the spring in the latch being

weak, and also with the dog wearing and the notches of the quadrant being worn. That wearing of the latch parts and the quadrant causes the reverse lever to chatter or vibrate more or less. At times there is a tendency for it to work up out of the notches. That tendency is more pronounced when that engine is running at high speed. As to whether you get a kind of a vibration from the travel of the valves on the hand lever, at high speeds you get more vibration than at low speeds. I have run along with my hand on the lever and have felt that vibration. When I go to let the lever out of the quadrant to drop it down or hook it up, I have felt a pull of that vibration from the valves. How I handle the lever when hooking up at high speed, 35 or 40 miles an hour, depends altogether upon the class of engine you are running. Some engines I do that from the seat box; with others I have to do it while standing. That is hooking up or letting down either. It doesn't make any difference. Where I put my feet depends altogether upon the circumstances. Sometimes I put my foot, if I am sitting on the top of the drop seat, against the brace or against the window. As to how high up the window is, some of them are pretty high and some of them are not quite so high. I put my feet up there as a matter of habit more than anything else. I just formed that habit from running a locomotive. I do not put my foot up anywhere like that when I turn on the squirt hose. As a rule I do not operate the squirt hose. The fireman usually does that. When I put on the injector I do not put my foot up like that. As to whether I brace myself with my foot up on the window or anywhere else when I pull the throttle, if I was sitting in that position I might. I have done it. I suppose that is for the same purpose as when handling the reverse lever. It is a matter of habit with me more than anything else. I did have a habit
1075 of doing it with my throttle. I don't run an engine much now. I did have in those days when I was running engines. Every time I handled the throttle I put my foot up there. I couldn't say how many times I would do it. That would depend upon how I felt and the mood I was in or the condition of the locomotive or the kind of locomotive that I was running. I couldn't say under what kind of moods I would put my foot up when I would handle the throttle. It was only under conditions where I had an engine out of the shop where she was hard to handle that I would brace myself when handling the reverse lever (tes., pp. 3797–3811).

Our maximum speed on freight trains for handling the reverse lever is 35 miles an hour and on passengers it is 60 miles an hour. I handle the lever at 60 miles an hour. When I do that I do not do it with one hand because I use the left hand to raise the latch and the right hand to handle the lever. As to whether it would be safe practice to unhook the lever going at 60 miles an hour and handle it with one hand, I wouldn't do it because I would usually use both hands because the ratchet on the lever is wide and you can't always raise the lever and grip the lever at the same time, that is, raise the

latch. You can release the latch as easily at 60 miles an hour as you can when the engine is going ten. There is nothing to keep you from releasing the latch at any time. You can do it with one hand, so far as handling the latch is concerned, at 10 miles an hour as easily as at 60. I take two hands at 60 miles an hour instead of one because that is my general practice. As a rule, I use both hands in reversing the manual reverse under all conditions. I do not necessarily brace my feet when I am handling the lever when I am going 60 miles an hour. At times I might. I don't make a practice of that. I would say that I do not take any different position at high speed,
1076 50 or 60 miles an hour, or handle the lever in any different way than when I am going 10 or 15 miles an hour. We do not instruct our engineers to take any different position when going at 50 miles an hour or 60 miles an hour than when going at 10 miles an hour. I have not instructed our engineers to take any extra precautions when going 60 miles an hour over slow speeds. The customary position of our engineers when they handle the lever at 50 or 60 miles an hour would depend upon the class of engine they are running. As to what classes I have in mind that go that fast, on those engines that we have on which we have the seat box where you do practically all of the running while sitting on the seat, they usually take both hands to change the position of the reverse lever. They do not necessarily brace their feet on the foot brace or against the boiler or some part of it. Some of them may do that and some of them sit with their feet on the floor, like that [illustrating]. I am not in position to give you the names of engineers who sit with their feet on the floor and do not brace their feet when running an engine 60 miles an hour. I ride with them and I know them. I know they do it because I have noticed them doing it. I couldn't tell you what engineer I have noticed. I have nobody in mind. I cannot name a single man I have ever observed do it.

In enumerating the causes of hard handling of the reverse lever, among many was dry valves. As to whether I stated the engineers were responsible for dry valves, the engineer is responsible for the lubrication of his engine. That means that they are responsible for the proper lubrication of the valve. I have had dry valves when I was an engineer. I was responsible for it. As to whether I was maliciously guilty of them being dry, they were dry from my negligence that I did not watch the lubricator properly. We do not have dry valves very often these days on the Louisville & Nashville.

I don't know of any engineers who have ever been disciplined
1077 for dry valves on the Louisville & Nashville. An engineer is responsible for dry valves if he is negligent in watching his lubricator. The lubricators that we have on our locomotives are subject to change in feeding due to different atmospheric conditions—the wind blowing on the lubricator, and an engineer might set his lubricator while the engine is standing still a sufficient length of time before departing time so that his valves would be lubricated when he gets ready to start, and after he gets started if he does not

notice that lubricator periodically it is liable to slow up and cause his valves to get dry. That is the condition under which the engineer might be responsible, if he is negligent in oiling his valves through his lubricator by failure to observe the lubricator properly. I couldn't give you the name of any engineer under my supervision who has failed to perform his duties as I say he should perform them, but I have noticed those conditions several times. I have noticed engineers failing to do that. I call the attention of the engineer to it but I do not make any other report of it. When in my judgment the failures are sufficient to justify my reporting to the officer in charge, it is my duty to report failures of enginemen. As to whether I considered this of enough importance to make a report, I considered I could take care of the situation myself without burdening the office with it.

In connection with this engine going into the pit, it was backing up. I stated that the reverse lever in the case at Decatur was in back motion and the link motion was in back motion. The tank of the engine got into the pit. The engine proper did [not get] into the pit, due to the fact that the tank went down and that stopped the engine. From the stall to the pit is practically level. The tank was damaged and the trailer was damaged. The air pipe between the engine and the tank was broken. It still had 30 pounds of air when I got on it. I have no idea how much air it had when
1078 it started out of the stall. What we term the A. T. brake was on this engine.

"Q. Straight air?

"A. The engine and tank. The E.T. is the independent brake that operates the engine and tank only."

It is a little independent valve, as well as the automatic valve. I would say the engine was moving three or four miles an hour, or possibly five, when I noticed it going towards the pit. As to whether I ever attempted to stop a light engine on lever [level] track moving at that rate of speed with 30 pounds of main reservoir pressure with the straight air-brake valve, I never made any test of that. I don't think it could have been stopped with 30 pounds of air.

As to how our engineers know that their lubricating system is working properly to the valves, the engineer is instructed as to the number of drops of oil per minute to oil the cylinders and valves. It varies according to the different engines. The superheater engines, the passenger engines on real fast runs are four drops per minute into each cylinder and each valve. On the smaller engines it is a little less, and on the heavy power freight engines we feed about three drops to the minute—both cylinder and valve. How many drops will drop in a minute depends upon how fast you are feeding it. If you are feeding four drops to the minute you should get a drop there every 15 seconds. I said four drops to each valve and four drops to each cylinder. That means there are four places where there are four drops going a minute. That is 16 drops a minute. In addition to that, there are two other places where oil

is going in those same lubricators. As to where the engineer sees these drops, the lubricator has a sight feed glass on it. The lubricator feeds up through this glass, and he can tell when the drops drop by looking at it. As a rule he cannot see that glass sitting down. On some of our small freight engines he can see it
1079 when he is sitting down. Generally speaking, on our engines he cannot see it. He can see it when he is standing up in the cab. All he has to do is stand up and look at it. It is illuminated in some way so that he can see it. On some engines there are four of these indicators to observe, on some engines there are six. He can observe all of them from the one position. He cannot tell how fast all of them are feeding at one time. You can look at two of them at one time, but you cannot look at sixteen unless you are cross-eyed. I don't know whether you can if you are cross-eyed. I just imagined that. How long it would take the engineer to actually determine by count if the lubricating system is working properly depends altogether upon how fast he wanted to feed it. It makes a difference how fast you feed it.

"Q. That is, as to how long it will take the engineer to tell whether it is feeding right or wrong?

"A. We instruct our engineers to set the lubricator with their watch. They do that before leaving, while the engine is standing still" (tes., pp. 3811–3824).

We do not have them check it by the watch when they are running. They can check it by noticing to see how fast it is feeding. As to whether the engineer can keep a look-out ahead while he is observing the lubricators, if he is looking right at the lubricator he will not be looking ahead, of course. He cannot do it. As to whether he can adjust his lubricating drops as quickly as he can adjust a power reverse operating lever, it only takes from three to four seconds to operate a power reverse from one end of the quadrant to the other. Dropping a power reverse from one notch to another would only take a fraction of a second. It would be impossible to look at the lubricator and tell how fast it was feeding in a fraction of a second. I would not say that the amount of attention that the engineer must give to the operating lever of the power reverse is really a
1080 negligible thing. It does not take an appreciable length of time to handle it as I explained it. As to whether it takes longer to watch the lubricator, he does his watching of the lubricating while he is standing or stopping at stations, as a rule. You can observe all of the lubricating indicators without getting into the plane of movement of the manual reverse bar. That is true at all times. The lubricators are on the engineer's side where the engineer can see them without getting away from his position in the cab.

We have the same lubricators on the manual reverse equipped engine that we have on the power reverse equipped engine. We use the same quality of oil on the engines of the same type and size with the one as on the other. The location of those lubricators on the manually equipped engine is practically the same as the location on

the power reverse equipped engine. I did not say we used the same amount of oil on the power-reversed engine as on the manual. We use different amounts of oil on different classes of engines. The engine equipped with the power reverse and the engine equipped with the hand reverse of the same class, the amount of oil we use is exactly the same.

(Witness excused.)

W. N. SPALDING, of New Haven, Conn., age 57, employed by the New York, New Haven & Hartford Railroad as locomotive engineer, testified:

DIRECT EXAMINATION

I have been employed by the New York, New Haven & Hartford for 29 years. I have served four years and eight months as a fireman. I have run an engine since November 8, 1907. I have been in service practically all of the time since that date. I have run engines in all classes of service, and all types of engines. I have only been em-
ployed in switcher service for about two years. It was approx-
1081 imately that, or it may possibly be a little bit more, but not very much. I have had about three years freight service approximately. The rest of my time has been in all classes and kinds of passenger service. I have operated engines equipped with manually operated reversing gear and also those equipped with power reversing gear. I have had experience with the power reverse gear ever since they were first installed on the New York, New Haven & Hartford System, about 1915 or 1916. Since that time my service has been divided about fifty-fifty between the hand reversing gear and the power reversing gear. The greatest weight on drivers of locomotives I have operated equipped with the hand reverse gear is 161,000 pounds. That is what is known as the I–3, a Pacific type of locomotive. I have operated that in passenger service.

I never was injured myself and I never saw anyone else who had been injured by the hand reverse gear. As to what extent I have ever had any cases of the hand operated reverse gear becoming unlatched by itself and going down to the end of the quadrant, I have not had any go clear down to the corner, but after I have unlatched them myself and put them part way down I have seen them drop down slowly, but I never had an engine go into the corner that I remember. This was on a saturated engine and that was long ago. I don't just recall when it was. It has been 15 years possibly since I had anything of that kind occur. I have never had any occasions when the lever pulled or got away from me or got beyond my control when I was hooking up. I have always found there was plenty of clearance and plenty of room around the seat box and around the hand reversing lever on the engines which I have operated. As to the amount of strength I have been required to use in operating or using the hand reverse, I never yet saw the time I could not handle the hand reverse lever. In handling it I

have not at any time over-exerted myself in any way. I have
1082 not at any time noticed any effect upon me physically because of the handling of the hand reverse lever. In fact, I feel better after running an engine like a switch engine equipped with a hand reverse than I would with a power reverse. I get a little more exercise. I have had occasions when I operated one with the power reverse and then one with the hand, so that I have had occasion to compare the effect. As to just what way I have felt any better, it has given me a little exercise. I felt better physically.

As to what difference I have noticed as to my ability to take slack with the engines equipped with the hand lever as compared with the power reverse equipment, I would rather have a hand reverse lever to take the slack. There have been places where with the power reverse I have lost the slack before I could get the power reverse in the other motion. I have not had that happen with the hand lever. I can handle a train and if necessary for me to take the slack I can handle the train smoother in starting with the hand reverse than I can with the power reverse, because I do not lose the slack, and I do not cause that unnecessary jar to the train. As to whether I am speaking of any particular kind of train or whether that applies to all trains, out of Hartford the Hartford depot is elevated and we go in there with 13 or 14 cars and it is very often necessary with us to take the slack of the train. Now, with the 13 or 14 cars the tail end of the train will hang over the other end. Well, you take the slack with the power reverse and pull it over and you start the train back, and before you get that power reverse in full gear again your slack has run out and it causes unnecessary jar to the train. I am speaking especially of a train like train no. 69, what is known as the "Springfield Owl." With the hand reverse gear I can reach up and take hold of my lever, pull it back and get the slack in a couple of cars and pull her down, and I am right out of town. That is a passenger train to which I am referring.

1083 I have not at any time called anyone to my assistance to help me handle the hand reverse lever. I have not at any time experienced any difficulty in observing signals or keeping a look-out at highway crossings in operating with the hand reverse gear.

As to my experience in switching service with the hand gear and the power gear as to my ability to switch, I would rather switch with the Johnson bar or a hand gear any time. It is quicker, and on all of the switchers I ever run I can sit down. Nearly all of our switchers in New Haven terminal are operated with the cars at the rear—back to the cars. And our engines are built so that we can sit on the window sill, and lots of us have seats built out a little wider than the window sill and we can sit there and move the lever any time we wish, and it is very convenient. In switching in that position, I am able to observe the signals from the switch crews at all times. As to how that compares with the operation of the power

reverse in switching, with the power reverse we do not have a seat as large as this and we have to sit this way [illustrating], that is, with the reverse lever here, and we are either looking out the back window or else we have to put our head out this way to see [illustrating]. We can't operate them sitting in the window as conveniently as we can the hand reverse gear (tes., pp. 3824–3834).

I have knowledge of elderly men who are holding down those hand lever switch engine jobs. Charlie Ralph up there—I don't know just how old he is but he is close to 75, and they just retired him about two months ago. He held a job in the passenger yard, a pretty busy job, for eight hours, up to the time of his retirement. They were kept busy all of the time. As to how long before his retirement he had held that job, Charlie has been on there thirty years. He was there before I came to work for them. I don't know just how old he is, but he is over 70, because I know they gave him his 50-year
1084 button some time ago. Fifty years with the New Haven. He had hand reversed engines all during that 30-year period, because he has always been employed right there on the passenger job, as I remember it.

As to my ability to maintain a positive point of cut-off in operating a locomotive equipped with a hand reverse lever, my experience has always been that the hand reverse lever has been the most reliable and most positive and most economical. As to my experience with the power reverse in that respect, I have not had a power reverse but what has crept. Perhaps the same engine would not creep all of the time. It would get a spell of creeping and we would report it and they would fix it and then she would be all right for a while, and then the first thing we would know she would get to creeping again. As to what the engine does when creeping, after you get her up in the running notch, as we call it, she might go along all right for a mile or two, and then the first thing you would know she would act as if you had put the lever down in the corner; she would commence to work hard and then she would do that for a short ways and then she would hook herself back again, and then she would go along that way, and then down she would go again. As to how far back the creeping has gone, I have had them creep back so that she would be about blind on one side. She would be in regular stroke or she would be in regular exhaust. As to what I have done to overcome the creeping, the only thing I could do was to feel around with the reverse lever to see if I couldn't get her at a point where she would not creep. It was not very successful. It usually needed the attention of repairmen. I never saw any material difference in my ability to observe signals going over the road with the power reverse as compared with the hand reverse. I never saw the time when I could not observe signals with either gear.

I had one occasion with the power reversing gear freezing. I went out to get my engine off the storage track in Springfield
1085 one cold night, and I found the reverse gear frozen. I notified the foreman and he came out and thawed it out. It

worked all right after that. I didn't have any trouble. I have never had a hand reverse gear freeze up in the winter time.

There is no material difference in the amount of coal consumed in operating with the power-reverse gear as compared with the hand lever when the power reverse gear was not creeping, but when the power-reverse gear was creeping I found quite a lot of difference. I can't say the actual tons. I can perhaps explain what I have in mind. I ran engine no. 1382 for quite a while on a highball job from New Haven to Springfield. It is a pretty lively job, with ten cars. When she was doing business we could go to Springfield and back and not use a coal pusher. If she got to creeping we would have to use the coal pusher before we would get back. Now, you understand I cannot tell you in pounds, but from observation of the coal pile I know that she was using more coal.

I don't know what opinion I have from the standpoint of safety as between the hand-lever equipment and the power-reverse equipment. I do know this, that with the hand-reversed engine that there isn't any mechanical appliance that is going to move the valve motion if you happen to be working around it, while I do know that with the power reverse there is something there that is liable to move (tes., pp. 3834–3840).

January 30, 1931

CROSS-EXAMINATION

In my experience I have found that the manually operated lever works harder at some times than at others. It has been my experience that engines just out of the shop after repair work and engines that have been run short on oil, and, perhaps, an engine with
1086 the counterbalance spring just out of the shop which has not been adjusted, which should have been adjusted. I don't recall of any time we have counterbalance springs get out of adjustment at other times than when they first come out of the shop, because as soon as an engine lever commences to work hard it is immediately reported and fixed. I have reported them for having the counterbalance spring out of adjustment at times other than when they came out of the shop. I have not had binding in the link or the bushings at times other than when they have just come out of the shop. I can't say that I have had the experience in cold weather of the links tightening up and the block, due to frost. As to whether I find the lever works harder in the winter time when there is frost on the parts of the valve motion than in summer time, it is hardly noticeable. I do not recall any specific case that I can cite where I have found that condition at all. One occasion that I remember the power-reverse gear froze. The temperature was below freezing then. How far below I cannot say. We do not have the experience of frost getting on the parts of the locomotive and snow working around in them very much up our way. We don't have very much winter weather.

I don't know whether the lever handles harder when you are reversing the engine with steam in the cylinders than it does ordinarily. I never experienced much or any difficulty at all in throwing an engine over. Naturally there would be some difference in the handling of the lever with steam in the cylinders as compared with when it is not there. I find steam in the cylinders when the throttle is open. I don't know of any other time when there would be steam there unless the throttle was open. When you are taking slack and make the rapid movement of the lever, there is a chance for steam trapped in the cylinders. There is not much difference in the amount of strength it takes to operate the manual reverse lever or the power reverse lever. I do not notice any difference when I am taking
1087 slack at a station. I don't see much difference in the power I have to exert on one as compared with what I would on the other. There might possibly be a difference when there is steam in the cylinders, but I never had any difficulty. Naturally there would be some difference when the valves are dry. I could not say which lever takes the more strength under those circumstances, because with the power reverse gear I do not handle the valve directly. I don't know that I see any particular difference in the amount of strength that I use myself to handle the lever. Naturally there would be some difference when the counterbalance spring is out of adjustment. There is no difference in the amount of strength required to handle the power reverse operating lever under any condition of the locomotive, but there are some power reverse gears I have known that have required a little more pressure to move. I would notice an appreciable amount of extra strength required in handling the power lever. I have seen power reverse levers that worked much harder than others. I don't recall just the type, because I have run all types of power reverse gears. I recall that some gears work a little harder than other gears. All that the hand operating lever of the power reverse gear does is to move the valve. As to whether it takes any great amount of strength to operate that control valve, different reverse gears work differently than others. Some require a little more strength to move than others. As to whether that is only the amount of strength that may be reflected by the lubrication in the pin at the bottom of the operating lever quadrant, some are much slower than others. It requires a little longer pull. As to whether it is when you try to hurry one of those slow fellows that you get the push, there are no two types of valve gears that work exactly alike.

(Witness excused.)

1088 J. J. FITZGERALD, of Maybrook, N.Y., age 45, employed as locomotive engineer by the New York, New Haven & Hartford Railroad, testified:

I have been employed by the New York, New Haven & Hartford Railroad since 1902. I was employed as a fireman approximately four years. I have been running as an engineer since November 8, 1908. I have run all classes of service and types of power ranging from 71,000 to 295,350 pounds on the drivers. The highest weight of hand reverse gear engine I ran was 184,000 pounds on drivers. The range of the weights on drivers that I have run equipped with the power reverse gear is from 184,000 pounds to 295,350 pounds. The class of the smallest engine equipped with power reverse gear that I have run is the J–1.

I first started operating with the power reverse gear about 1916. Prior to that time my experience had all been with the hand lever type of reversing gear. I have had about ten years, the last ten years, service with the power reverse. Previous to that time it was mixed power and hand. During the last ten years I have had practically no service with the hand lever.

During the time of my experience of operating with the hand reverse I had plenty of room or clearance in the cab and around the hand reverse lever. I was not at any time interferred with by my operation of the hand lever in keeping a look out or taking signals. I never had to call for any assistance to handle the lever. I never had to use any great amount of strength to use the hand lever. In operating with the hand lever, I never overexerted myself in a physical way. I have not at any time felt any effect physically from my handling of the hand reverse lever. Usually when I went to change the position of the hand reverse lever, I put one hand on the window sill and took hold of the lever to pull it anywhere off
1089 I wanted to. I was never injured and never observed anyone injured with the hand reverse or in connection with its use in any way (tes., pp. 3841–3851).

With the hand lever I could always maintain a fixed point of cut-off with my locomotive in running over the road. As to my experience with the power reverse gear in that respect, about 50 percent of the power reverse gears that I ran crept so that I could not keep a fixed point of cut-off. As to how far the engine would creep, some of them were an unknown quantity. They will creep away below the proper cut-off and then creep back on center. By creeping I mean the piston moving in the barrel and allowing the valves to get in an improper position. I have become aware of the creeping on those occasions by listening to the cut-off and the general pound that follows after they drop down. As to the extent the amount of fuel consumed was affected by the creeping, I have a regular run and we go through the same performance every day, and upon my arrival at my destination we usually size up the coal in the tank, and with a bad reverse I have seen it use at least one-third more coal than it would ordinarily.

As to my experience with respect to the power reverse gear reversing itself, I had one failure of this sort. I was going to set off some cars at a place called Hawleyville. We cut the cars off and pulled over the switch. I put the engine into back motion and turned around and pulled the throttle open after they got the switch over, and the engine went ahead. So I put it in back motion and I watched it that time, and soon as the engine started to move back the reverse lever started to go ahead. It tipped right over into forward motion. There was no damage done. I just had to watch it closer the rest of the trip was all. As to whether the lever itself moved. I examined the latch or quadrant. The spring was weak or just the gears moved, everything moved. The lever in the cab in the latch. That was the real cause of it. The locomotive was just starting to move when it first reversed itself.

1090 I had two cases of the power reverse freezing about a year ago last January. I had just dropped down a 14-mile hill and I had the engine in forward motion. I cut off some cars to set them off and pulled ahead, and when I went to throw the reverse lever and put the engine in back motion it would not go in back. I investigated and found it froze, and I got a little waste and put it on the scoop and thawed it out. There was no delay to speak of that time. I had the same engine do the same thing at the very same place the following trip. I don't recall just what the temperature was, but it was very cold. I remember that. I have had no experience whatever with the hand lever type of reversing gear freezing in the winter time.

As to what difference I have noticed in my physical condition after doing a day's work with the hand reverse type of gear as compared with a power reverse type of gear, I always felt fine. But for physical condition, perhaps, I would rather have a manual reverse.

I am operating with the power reverse now. My seniority does not permit of my bidding in a job equipped with the hand lever in my territory at the present time. I got displaced off of a run that I had been on that had a hand lever on it, and if it is proposed for bids at any time I will bid it in again, because I always felt better on that kind of work.

As to what opinion I have from the standpoint of economy and efficiency of locomotive operation as between the hand lever and the power reverse, the power reverse is very inaccurate and there is no way to determine the waste of it or what it might be, while a manual reverse is positive and you never have any waste on account of the manual reverse. The two types of gears are about fifty-fifty on the safety end of it. I have operated the Alco and Ragonett power reverse gears.

1091 CROSS-EXAMINATION

For a steady performance I prefer the manual reverse, for its accuracy. I always felt better when handling them. I got enough

exercise and I slept better and ate better and had more pep. I couldn't tell you where I stand on the seniority list. It is pretty well up. I have been on power reverse for ten years steadily all but two years. I had one lapse of two years when I bid in a hand reverse during that time of ten or twelve years. There is no job with the manual reverse on it that I could bid in. Those have all got whiskers on them down to their knees that are on those jobs now. That has been true during the whole ten years.

About half of the power reverse engines creep—not my power reverse but about half of the engines I get do. I do not mean it is on about half of the trips I make. If you get an engine that creeps it will creep about the entire trip, but about half of the engines do not creep and half of them do. Half of them do not creep every trip. I mean just this, that when my engine is in for a boiler wash, which consumes from one to two weeks' repairs, I get a different engine every trip, and sometimes I will get two that will not creep at all, and perhaps three, and then I will get three that do creep; but if they do creep they creep the entire trip. About five trips out of ten I have creeping. About half. I would not say that on five out of ten trips I use a third more coal, because all reverse gears do not creep as badly as others. Some creep much worse than others. I have seen them when they would use quite a lot more than a third and they would almost clean the tank out when we ought to have a half a tank of coal left. Then, again, I have seen them when they used a third more. It varies quite a bit. It depends upon the extent of the creeping. About half of the time they will use a third more coal; that is, about five trips out of ten.

(Witness excused.)

1092 JAMES F. JONES, of Providence, R.I., age 55, employed by the New York, New Haven & Hartford Railroad as engineer, testified:

DIRECT EXAMINATION

I was first employed by the New York, New Haven & Hartford June 26, 1900, as a freight brakeman. I went into the engine service in 1903. I served as a fireman four years and a half; was promoted to engineer October 25, 1907, and ran as an engineer up until January 1917. I was fuel supervisor then until April 1921. I went back running then until September 1922 when I was again appointed fuel supervisor, and, right after that, road foreman. I continued in that work until May 15, 1927, and then went back running again. I have been running an engine since 1927 up to the present time. As to what service I have had experience in running engines, I have run everything up until about two years before I was made fuel supervisor in 1917, and when I went back running the next time I ran from April, I think it was, until January on a passenger train,

and from January to September on through freight. I have run heavy through freight between Boston and New Haven ever since I have been back running the last time. As a rough estimate I would say I put in about two years on regular jobs in yards (tes., pp. 3851-3861).

The first power reverse gear I ran was when I went on the freight when I was set back in 1921. I ran a passenger train about half of the time and a freight half of the time. I had a power reverse then and a power reverse ever since I went back running in 1927. I had the power reverse on freight in 1921. Since 1927 I have run with all power reverse. They have the Ragonett and Lewis and Barco power reverse on the New York, New Haven & Hartford. I have run all three of these types. I have heard the New York, New Haven & Hartford had some Alco. I have never seen one of them. I have never come into contact with them.

1093 I was never injured and have never seen anyone injured with the hand-operated reverse gear. I have had one case with the hand-operated reverse gear becoming unlatched. That was when I was set back or after I was set back in 1921. The quadrant and dog were pretty well worn out and just before we started the fireman went down and got the quadrant all wet, and that is the first time that she ever unhooked on me. As to what extent it went down when it became unlatched, it just started to slide when I caught it, and I held it after that when I started out—it was an accommodation train—until the quadrant got dry, and it never went down after that. But when I got in I reported it and they put a new quadrant on it, so I never had any more trouble with it. When I caught it it did not injure me or jerk me in any way. That engine did not yank any. There was not anything in connection with that experience which caused me to be conscious of any danger to myself in any way. I don't remember any experience of a lever becoming unlatched other than that one time.

The amount of room that I had in my engineer's position in the cab to operate the hand reverse lever is something I never thought about until I came in here. As I remember it, I have always had room enough. I don't ever recall calling anyone to my assistance to enable me to handle the lever. I have seen the time I was firing when I would like to have helped somebody hook them up, though. I mean by that that the engineer was working me too hard. As to my experience in operating with the hand reverse as to the amount of strength I exerted in handling the lever, I cannot say I recall any hard experience. You know engines do work a little stiff and they do come out of the shop. But over on the New Haven road we put our engines on the slip track and slip them, and then they put them on some local job and break them in before they turn them over to us. As to what I mean by the slip track, we have a track that

1094 is oiled and they put them on there and start them slipping and keep them slipping until they break them in. In other words, we get numerous revolutions of the reverse without very

much distance over the road. They run them for a long while there until they get pretty well broken in. The idea is to break in all of the working parts of the locomotive.

I don't remember overexerting myself in any way physically in the handling of the hand reverse. I do not recall the handling of the hand reverse having any effect upon me physically in any way. When I was running the switchers there they used to make me double quite often, that is, 16 hours, and I used to get tired but I always laid it to being in that little space for 16 hours. I never thought of the reverse. It seemed to me to be more of a strain after staying there and switching and watching those lights all night that tired me out more than any manual lever. I didn't know what I was coming here for and I didn't give that much thought until I got here.

I have never seen the time in any service when the use or operation of the hand lever ever bothered me in any way in keeping a look out or taking signals. As to what my practice was in switching with respect to the operation of the lever and the observation of the signals from the switch crew, practically all of the switchers I ran were hand reverse switchers, and we always stood up. When I was switching ahead I would lean with one arm on the window or on the window sill, sometimes with the half seat up there on the the arm rest. Most of the time I was leaning with one arm on it. My brake valve was up here [indicating], my throttle here [indicating], and my reverse lever down here [indicating]. The only time we ever put a reverse lever down in the corner is when we have a heavy drag going from one yard to the other. But in ordinary switching we do not put it down over half stroke. And I would be sitting there looking ahead. If they went back I
1095 would turn right around this way and my hand on the brake valve here [indicating]. Certainly I could reverse the engine without sticking my head back in the cab. There is no question about that. I can do that.

I have run some switchers equipped with power reverse only when I was acting as road foreman. I found the same operation much harder with an engine equipped with the power reverse in switching. Our seats are right up against the back of the cab. It is a little narrow seat, an ordinary seat box turned sideways, so the narrow part is between the cab and the front. When they are switching behind there is no way to stand up on them, and when they are switching behind you turn around and you are working under a strain all of the time. And my neck used to get tired that way. Then I don't think you can keep looking around and reach away and get hold of that reverse gear. As to what would be the situation on those same engines if they had a manual reverse lever, you couldn't put a manual reverse lever on there. There isn't room to put it. With the big boiler you couldn't stand up.

As to what has been my experience with the hand lever type of equipment as to my ability to maintain a fixed point of cut-off in

running over the road with my locomotives, it will stay where you put it. There is no doubt about it. The cut-off stays the same. The power reverse gear equipment in that respect creeps badly and it is hard to control it. You cannot control it.

"Q. To what extent have you had experience with the creeping, Mr. Jones?

"A. On that run we used to get these Vanderbilt tanks."

I refer to the run between Boston and New Haven and back. Through freight and heavy freight. We ran as high as 150 cars. Going east it was mostly all loads. If the conditions were good and if the engine was in good shape and with no creeping or anything like that, we could make Boston without taking coal at Provi-
1096 dence. When the engine was creeping we always would not dare take a chance; we would have to go into Providence to take coal.

I should say creeping has been quite frequent in my experience. I can recall to mind a specific instance of creeping when I was road foreman. On one of our fast express trains, no. 22, we had an old engineer on there who is pensioned off now, whose name was Charles Hoyt. He was a pretty gruff old man. He would never give a man any information. I noticed he worked the engine very hard. I did not like to say anything to him. I rode from Boston to New Haven with him. I got back as far as Westerly going east and I couldn't stand it any longer, and I got over and took the engine away from him. Going up the hill, I gradually hooked the engine up, and after tipping over the top of the hill I set it in what I thought was the right running notch. We went along a little ways and the engine went clear to the corner; then it came right back. I shut the engine off. I let it do it a couple of times and then I thought that was handling the passengers rough enough, so I had to move the reverse lever down to where she would not come back and shut off. And then I eased off on the throttle just so that she would make the time. When I got into Boston I told the engineer I wanted him to come down beside the reverse gear with me. So we went down and I told the fireman I wanted him to stay up there and pull that lever over and count the notches out loud so that we could hear them, and he started in to hook her up and he counted one, two, three, and so on, up to seven, before the reverse gear moved, and when it moved it went the whole length. And it kept going back and forth until finally it eased down and stopped. That was a Ragonett. I would have to guess how long ago it was. Mr. Hoyt has been pensioned off about four or five years, and it was just before he was pensioned off (tes., pp. 3861–3871).

1097 As to my experience with engine no. 3507 in connection with the operation of the power reverse, I was in on the siding at Sharon Heights, and I stopped there with the independent brake. Of course, that brought the slack all in. An express train went by, and I started to follow them out, or we were going to follow them out, and when I pulled the engine out she wouldn't move, so I pulled

her over in back gear. Of course, I couldn't get any slack and she wouldn't move that way. No matter what I did the engine was dead. You couldn't get a sound out of her. I sent the head man down to tell them they would have to send someone to start me. And I got down and looked around the engine, and I saw one side was on the top quarter. I said, "The trouble can't be on this side." "Now", I said, "the trouble must be on this side, because she would stop on the top quarter. So I got a bar and put in behind the valve cross-head and gave it a little pull, and the engine jumped. The fireman was up there and he put the brake on. Before I got down I had moved the reverse lever from one end to the other. That was the Barco power reverse. I can't tell you the exact time that occurred, but it was sometime last summer.

As to my recent experiences with the power reverse gear on engine no. 3309, I went on that engine about the first of June of this year. One time I reported the reverse to give her a good oiling. That didn't do any good. The next trip in I reported it working very hard. As to what experience I had that caused me to make those reports, I could pull it back with one hand, but very slowly, and when I got it in the back corner, of course, there isn't so much room there, and I couldn't get a very good brace so I had to use both hands to get it out of the back corner. I imagine I could if I had a good long reach.

I have had two engine failures with no. 3500 due to the failure of the power reverse to function. That is an R engine, two
1098 Barco gears. On both of them the nipple broke out of the power reverse cylinder. Two different engines, both of the same class. One of those cases happened coming up the hill between Midway and Groton, and, of course, we stalled on the hill there. There were three curves in the train, and it was up-grade. I used the monkey wrench to set the gear with, but I couldn't get the train out of there. So, as long as we had to wait for a pusher, I decided to turn the engine in there and get another engine. I should guess we were delayed around two hours on that occasion. The other occasion was at Waterford, this side of New London. The same thing happened but a different engine. I cannot give you the number of that engine. I forget which one it was. This nipple that broke off forms the T. There is a T on the end of it, and the steam pipe and the air pipe come into this T. There are two check valves, one in the air pipe and one in the steam pipes. So when you are using the air the air cannot get back up through the steam pipe but will go into the nipple in the reverse cylinder. It is the same way when you are using the steam; it will go through the check valve in the steam pipe. It will not come back through the check valve in the air pipe. Either air or steam will go through that nipple into the power reverse cylinder. It broke off in each of these cases. It was useless. You couldn't use either one. The second case resulted in some delay, but I cannot tell you what the delay was. I set the engine at about half stroke with a monkey wrench and I went along in. I went about 45 miles into Cedar Hill, where we go in with our freight trains—at New Haven. I couldn't tell you the exact time it took me to oper-

ate my reverse gear by using the monkey wrench after I discovered I could not operate it with the lever. I know it was very tiresome. I know I was hanging on the running board with one hand and my
feet around the main pin there on the rods, and I had to work
1099 that monkey wrench this way [illustrating]. You see, the
running board runs away out over the rod, so that you are bending on a slant there. I was standing on the rod.

As to what experience I have had with the reverse gear moving when I was oiling around the engine with no one operating the lever in the cab, I have had it jump several times. It jumps without warning. I couldn't tell you how. When it jumps, it jumps quick, and you jump quick if you are around where the reverse cylinder is. On this side you don't notice it so much. I know one time it was jumping about every minute. I called the fireman down to see it.

From the standpoint of the efficient and economical operation of the locomotive as between the hand lever and the power reverse type of gear, I don't think there is any question whatever but that the hand reverse gear is the most economical. From the standpoint of safety as between the hand lever and the power reverse type, I never saw or knew of anybody being injured by either one. I think the hand reverse gear is the safer.

CROSS-EXAMINATION

I am a member of the brotherhoods. We have some Lewis gears in service at the present time in my territory. I couldn't tell you how many. They are kind of mixed up. They are used mostly in heavy-freight service, I think. I couldn't tell you how old the gears are. I think our first power reverse in any service came there around 1915. I don't know when the Lewis came. I haven't the least idea about that. I couldn't say whether they were on after the war. I couldn't say whether they are less than ten years old. I haven't the least idea when they were put on the engines. As to whether they have been there as long as I can remember when they had any power reverse, some of the engines that came with power reverse have been changed, I believe, to Lewis. I am not certain, but I believe
they have. When it was done I cannot tell you. That is just
1100 my thought, that they have been changed from Ragonett to
Lewis. I was fuel supervisor. I did not observe the appliances so much in those days, so far as taking care of them is concerned, and the operation. As to whether I have observed any new ones in the last six or eight or ten years, I do know that the Barco came here new when those engines came here, the 3500's. I think we have had those engines around five years. I should say we got our Ragonett gears around 1915. It was right close to that time. I wouldn't say positively, but it seems to me that they did change some of the Ragonetts and put Lewis on. I cannot say that the Ragonett gears we got around 1917 are those that I am talking about on the engine that Engineer Hoyt was involved with, because we

have different types of Ragonett, and when the later type came I don't know. I can just simply tell you that they had Ragonett gears. I don't know whether any new Ragonett gears have been applied in the last eight years. There is no way I would know.

The heaviest weight of engine that I have ever operated is 260,000 pounds. That was 4–8–2 type of wheel arrangement. Those are Barco reverse gear. The lightest weight of engine that I have handled since I went back running the first time in 1921 was 68,000 pounds on drivers, type A engine. The heaviest type of manual-reverse engine I have operated is 161,000. There probably is a little difference in the way in which the lever handled on the 68,000-pound engines as compared with the larger ones. The engines do not handle the same, but I think the 161,000 handled a little harder. I don't know anything about whether I could easily handle the 260,000-pound engines if they were equipped with the manual reverse. I couldn't say. I couldn't say whether I would prefer power reverse on that sized engine until I tried both of them.

I have fired engines equipped with power reverse; when I was fuel supervisor I broke in a lot of firemen on them. I did not
1101 do that as a fireman. They didn't have them at that time (tes., pp. 3871–3881).

As to whether the engineers work their engines cut back fine, or at half stroke, or hard with power reverse, some engineers work them with a very fine cut-off, just where they can make the schedule of the train. And other engineers will work them with the longer cut-off, and really longer than necessary. And it was my duty to instruct such engineers. I attribute some engineers' working them with much longer stroke than necessary to the heavy consumption of coal with the power reverse.

I replied to a question that I had seen the time when I would have liked to have assisted somebody to hook up an engine. I meant by that that during my experience as a fireman I fired for some engineers where they didn't care where they hooked them, and I would like to have helped them hook them up. That was with manual-reversed engines. As to whether I ever found that condition with the power-reversed engine, I didn't fire under those conditions.

I stated that I could make Boston for coal if the gear was not creeping. As to the division point from which we started, we started out of New Haven. And we get coal and water at Midway and they expect us to make Boston for coal on account of the time it takes to get coal in Providence. They do not like to have us stop there. If I said on one occasion the reverse gear crept badly and I couldn't make Boston for coal, I didn't mean one time. I meant several times, although I can't tell you how many. When we started out of New Haven and the engine was creeping I would have the fireman say, "Well, we will never make Midway to Boston tonight with the engine creeping the way it is." I wouldn't say that occurrence was frequent, but occasionally. I do not remember the fire-

man who said we would never make Boston tonight. They changed so often over there that you can't keep track of them. I
1102 couldn't tell you where I was when he made that remark.

We had started on our trip. As to whether I ever had to get coal on that same trip to make Boston with an engine equipped with the manually operated reverse gear, I never ran one of them in that service. We don't run them in that service. I have had to take coal on an engine that did not creep. If we had to set off a hot box or something.

If I remember rightly the engine I pulled up notch by notch and it did not respond until it got [to] the seventh notch was engine no. 1352. I am pretty positive. The fireman was Thomas Gallagher.

I cannot recall approximately the number of engine failures due to the failures of the power reverse in the past ten years. Of course. I have only been running back this last four years. I cannot during the time that I was road foreman and the time I was an engineer. I never kept any track of it. I could not say whether we have had as many as a half a dozen engine failures due to power reverse failures. I wouldn't say anything I couldn't swear to. Certainly we have had engine failures that were not caused by power reverse. I couldn't answer the question as to how they compare.

In the case where I drifted into the side track at Sharon Heights, I couldn't find anything wrong with the locomotive. The engine was in pretty good shape. There didn't seem to be any lost motion when I worked the reverse lever. I went looking for it so I could locate it. But it seemed that there was enough so that I could move the main valve, the steam valve, over the right cylinder a little. That side was on the quarter. I got this coal bar we have on the engine and put in back of the valve cross head and moved it ahead a little. The valves had the ports blocked. It is a question whether that has any relation to the power reverse gear. I am not a mechanic.
1103 Counting my first experience I have run an engine since 1907.

No part of the power reverse gear reaches to the steam valve connection, but it handles it. The power reverse gear moves the steam valve. It is supposed to. I didn't find any lost motion. There wasn't enough so that I could book it, but I did tell the general foreman at the roundhouse about it. But I didn't have that occur again. I could not find anything wrong with the valve gear. I didn't find enough lost motion in any port of the valve gear that I didn't find it necessary to book it. I couldn't tell you what part of the locomotive machinery moved when I moved it with the bar. I know that I moved the valve a little and that is all I can tell you. I moved the cross head. I was watching to see if I could find out what would happen if I could get that engine moving. I don't know whether, when I moved the reverse lever bar, the valve motion of the engine moved prior to my moving the steam valve. I presume it did. But it didn't move enough. I couldn't say that the valve motion moved but there was sufficient lost motion not to move the steam valve. I found nothing wrong with the power reverse gear.

I couldn't find lost motion anywhere at all. I couldn't tell you whether the power reverse gear functioned like it ought to or not. I didn't see it. I couldn't see it in the cab. I threw the lever from front to back. It didn't move the steam valve sufficiently on the right side to admit steam to the cylinders. It probably might have on the left side, but that side was on the center.

(Witness excused.)

EDWARD LANDERS, of 205 Burnside Avenue, East Hartford, age 54, employed by the New York, New Haven & Hartford Railroad as engineer, testified:

1104 DIRECT EXAMINATION

I hired out to the New Haven road May 1, 1898. I worked as fireman from 1903 to 1912. I was promoted to be an engineer in 1912 and have been running as an engineer ever since that time. I have had two years in passenger service, four years in local freight, and the rest of the time in yard service. I have run, generally speaking, all of the various types of engines that the New York, New Haven & Hartford has in my territory. I worked from Springfield to New Haven. At the present time I am working in Cedar Hill terminal yard, what they call the west hump. That is in the New Haven switching district. I have operated with both hand reverse and power reverse gears at different times. I have had experience with the power reverse gear only the little time I have been on the hump in New Haven. That is from 1926 to the present time. My experience with the power reverse gear has been only in yard service. I never ran one out on the road equipped with power reverse. This hump at New Haven is a hump yard (Tes., pp. 3881–3891).

It has been my experience that it required very little strength in handling the hand reverse. I have never at any time over-exerted myself. I have not at any time noticed any effect upon me physically from handling the hand reverse. I have never been injured and have never seen anyone injured by a hand reverse or in connection with its use in any way. I have never had any experience with the hand lever becoming unlatched by itself and going down. I have never had any occasions after I had unlatched the lever when it got away or pulled away from me or got beyond my control in any way. I have never called anyone to my assistance to help me handle it. I was always able to do it myself. I always had plenty

of room in the engine when operating with the hand lever.

1104 I have never experienced any interference in my keeping of a look-out or taking signals when I was operating an engine equipped with the hand lever.

I was injured with the power reverse, on January 20th, 1928, in Cedar Hill yard. The engine number was 3614. I went down to the classification yard, what they call track No. 48. That is a rip

track. We had a whole lot of rips down there. We stayed down there about 15 or 20 minutes waiting for a signal. The brakeman came and said, "You have them all." So I took hold of the engine and reversed her and she was frozen up. The gear was frozen up. I got out of the cab and took some waste and oil with me and I put some waste and oil on the pipe that leads to the top of the drum. There is a pipe that leads to the top of the drum. I put waste and oil around that pipe. It was bitter cold and windy, and when I applied the torch to the waste a piece of that waste hit me right here on the arm and raised a blister about the size of a 50-cent piece on my arm. I worked that night. I did not work after for 14 days. I was off 14 days. That was a piece of waste I was thawing it out with and I burned my wrist. I was able to continue with the operation of my engine. When I went back on the hump it was froze again into back motion. I tried to thaw it out again but I couldn't thaw it out, and I called for another engine. I turned that engine in and got another.

CROSS-EXAMINATION

I think I got a 360 engine when I turned this one in. She was equipped different as to reverse gear. It was power reverse. That did not freeze. The last time I thawed out the power reverse I did not burn myself. That was the Alco gear. It was Alco on both engines.

(Witness excused.)

1106 WILLIAM E. PECTAL, of Falls Village, Conn., age 55, employed by the New York, New Haven & Hartford Railroad as engineer, testified:

DIRECT EXAMINATION

I was employed as a fireman in 1902 and promoted to engineer July 12, 1907. I have been running as an engineer practically all of the time since that time. I have run in all classes of service. I have run the Stephenson valve gear. I have not run all of the dif-
territory. I have run the larger type, the Santa Fe type. As to what extent I have had experience with the hand-lever equipment on engines and to what extent with power reverse, it was two years power and the other was hand reverse. The last two years was power reverse. For the last two years it has not been all power reverse; it has been at intervals. I never had any power reverse prior to the last two years. I have had experience with the Lewis power reverse. That is all. It was in through-freight service that I have had experience with the Lewis power reverse gear.

I was never injured and I have never observed anyone else injured by the hand lever or in connection with its operation in any way. A few years ago, possibly seven or eight years ago, I had a hand reverse come unlatched, but not since then. It just came unlatched

and went into the corner. That was all. Nothing occurred to me. I didn't even try to find out. I got the engine to the terminal and she was repaired there. I don't know what repair was made. I reported it on the work book that the engine jumped out of the quadrant. I had it afterwards and did not have it happen again. When part way over the division, that is, between the two terminals, when this happened, it just became unlatched and went into the corner. That is all I can tell. I used the engine to the terminal and there was no bad result. I was going along the road at the time. I
1107 was not trying to hook it up; I had not touched it. I was just looking out the window. I don't remember where my left hand was. It was not on the lever.

I have never had any occasions when after I had unlatched the lever it pulled away or got away from me or got beyond my control in any way. I don't think I have ever called anyone to my assistance to enable me to handle the lever. In handling the hand lever I just reach down and get hold of the lever and pull it into the position required to run the engine. I do that from a sitting position. Sometimes I use one hand and sometimes two in doing that. I always had plenty of room in the cab with respect to the handling of the lever. I never had any trouble or any difficulty in keeping a look-out or observing signals or taking signals from members of the train or switch crews. I never noticed any difference in my physical condition at the end of a day's work when I was operating with the hand-lever equipment as against operating with the power-reverse equipment (tes., pp. 3891–3902).

The hand-lever equipment is positive to maintain a fixed point of cut-off. The power reverse gear would creep. You could not maintain a positive cut-off. In my operation over the road that creeping was sometimes bad and sometimes not as bad. I experienced it quite frequently. When the engine would creep bad it would have a bad effect upon the fire. As to the effect it had upon the performance of the locomotive and its operation, it would get bad at times and you would have to ease off on your throttle and arrange your cut-off all over again. A locomotive equipped with power reverse gear it is not creeping, that is, from my point of observation. As to whether I have had any runs where I ran a locomotive equipped with the power reverse and another run at some other time with a hand reverse where they were both the same class of engine,
1108 they are both the same class that I have run that are equipped that way, that is, the F–5 engine. I have run that class of engine, the F–5. I have run the same class of engine handling the same class of train over the same territory. Comparing those two types of equipment, the hand lever and the power reverse on that same class of engine, the F–5, on the same run, when the power reverse was creeping the consumption of coal on the power reverse was practically greater than on the hand reverse. The approximate

weight on the drivers of that F–5 class engine is 184,000 pounds. It is a through-freight run that I have been comparing.

I have occasion to do local switching on that run, at three points going south. The hand reverse is much quicker than the power reverse in performing the local switching on that run with that class of engine. I do not see any difference in the two types so far as the switching is concerned.

CROSS-EXAMINATION

I have been an engineer since July 12th, 1907. All of my experience has been on hand reverse, but the last two years have been power reverse. I have had power reverse possibly a year in the past two years. In those two years off and on we have had power reverse. All of my experience has been in those two years. I have operated the F–5 consolidation engine with power-reverse. That weighs 184,000 pounds. That is the only class of engine which I have operated with the Lewis gear on. The Lewis power-reverse gear was on it. That is the only type power-reverse gear with which I have had experience. I have had about a year's experience on F–5 locomotives equipped with the Lewis power-reverse gear. That was in through freight service between Pittsfield, Mass., and Danbury, Conn. At three different points we do local switching on our through freight. I have operated the same class of engines equipped with manual reverse in the same class of service. I cannot describe
1109 this Lewis power-reverse mechanism. I cannot tell you anything about it, only that I have used it. I know it creeps, the valve gears creep. Possibly two months ago was the last time I saw one. I used it about two months ago. It is operated by a lever in the cab. There is a cylinder on it, the same as the other power gears, and a short reverse lever which is connected with your valve motion. That is the only explanation I can give of it. It works by power. There are no locomotives of the same type equipped with any power reverse other than the Lewis. I do not know whether that Lewis reverse gear mechanism was a new device when they put it on this locomotive. I do not know whether it was discarded from some other type of locomotive. I never saw it until it was on those engines. I do not know that the Lewis power-reverse gears were taken off some other locomotives and put on these that I was operating.

On the northbound trip, the tonnage of these trains which I haul is 1,250 tons. It varies on the southbound trip, possibly 1,200 to 1,500 tons I have had. As to whether there is any variation going north, it is according to what they have for us. Sometimes it would be a little lighter, but very seldom over 1,250 tons. We might have 1,000 tons going north. The locomotives are all hand-fired.

I noticed the coal consumption on all trips with one of these locomotives that had a manual reverse. I do not know which way I

ran on the second of March, or the number of my locomotive. In my judgment, the manual reverse bar is more economical than the power reverse bar. I stated that I had noticed the difference in coal consumption, that I did that on trains of the same tonnage, in the same class of service, and over the same territory. As to what trip I made my observation of the coal consumption with a manual reverse bar for the purpose of making this comparison, I do not know that we made it for the purpose of any comparison. You would notice it. That is about what you would look at when you get through with your work. I have never made any actual comparison of the coal consumption on any two trips specifically, only as I got off the engine I would look at it. When we had the power reverse I arrived at the conclusion at that time that I was using more fuel on account of the creeping of the power reverse. I do not think I mentioned it to anybody. I have heard tell of it before I came to Washington on this case. I have talked it over with some firemen. I have talked it over with F. N. Sheppard. He lives at Pittsfield. I cannot tell you the exact date when I talked it over with him. It was possibly four, five or six months ago. I do not know that we had any special case when I talked to him about it.

1110

"Q. You mean you were talking over the efficiency of the power reverse with no particular occasion to do so?

"A. Well, because on account of the engine creeping, it would naturally consume more coal."

I do not think I have talked with any more firemen about that. I cannot give you a date as to any trip that I made upon which I noticed excessive fuel consumption when I was having a creeping power reverse. As to whether I came here to testify to that effect, I came here to testify as near as I could to the truth. I do not keep any records of those trips in any of my work books or notebooks. I do not keep any record at all of unusual occurrences on my trips. I cannot state any special date upon which I had a creeping power reverse that used excessive coal (tes., pp. 3902–3915).

(Witness excused.)

A. C. ADAMS, age 65, of Norfolk, Va., employed by the Norfolk Southern Railroad as superintendent of motive power, testified:

1111

DIRECT EXAMINATION

I was machinist apprentice from 1884 to 1886 on the Missouri Pacific Railroad. Machinist, pit foreman, roundhouse foreman, general foreman, and master mechanic for 18 years on the Rock Island Railroad. One year as master mechanic on the Chicago, Burlington & Quincy Railroad. One year as master mechanic on the Delaware, Lackawanna & Western; 2½ years as master mechanic on the New York, New Haven & Hartford Railroad; three years as superintend-

ent of motive power on the Spokane, Portland & Seattle Railroad; 1½ years on the Seaboard Air Line as master mechanic; one year as shop superintendent at Reedville, Mass., on the New York, New Haven & Hartford Railroad. During Federal control, I was on the railroad board of adjustment no. 2 until all the labor cases were disposed of. On January 1st to date, superintendent of motive power on the Norfolk Southern Railroad. During that period I have had occasion to supervise and direct the operation of locomotives, and had occasion to observe the operation of reverse gears. From my experience, study, and observation I can form an opinion satisfactory to myself as to the operation of the reverse gears, their design as affecting the safety of employees, and the public, and efficiency, economy, and ease of operation.

The Norfolk Southern Railroad owns and operates 105 locomotives. There are two divisions on the Norfolk Southern, the western and northern. The northern division covers from Norfolk to Marsden, from Marsden to New Bern and then to Beaufort and the branches. I could not answer offhand how many miles of road in that division, but 129 miles from Norfolk to Marsden. The northern division is known as a water grade, some small hills in it. The western division is quite hilly. The western division is that part of the road from Marsden to Charlotte and branches.

The largest engines that we use on the Norfolk Southern is the consolidated type, 2–8–0, 168,000 pounds on drivers, tractive
1112 effort 40,400. We have 19 of that class. These 19 are known as the 500 class. They are usually used in through freight service. One is used as a switcher to Middle Creek, the connection with the Pennsylvania Railroad. Those engines are equipped with hand reverse gears. The reverse gear is light, for that size engine, Walscheart gear. The next heaviest weight of engine is the 200 class. We have 16 of those. The weights of these engines of the 200 class vary slightly; 206, for example, is 144,000 pounds on drivers; and 207 to 211 are 153,525 pounds; and from 212 to 217, 158,150 pounds. We have three of the 200-class engines equipped with power reverse of the 2–8–0 type. These engines weigh, one of them 149,000 pounds on the drivers, and two of them 154,000 pounds on the drivers. Then we have three switchers equipped with power reverse. Those three engines are used in switching service and intermittently in road service. I do not mean any special road service, occasionally in local freight. The Alco reverse gear was put on those three engines the latter part of 1929 and 1930. We put them on at the request of Engineer Warren and Engineer Riggs. Engineer Warren had lost a leg in the service and was one-legged, one limb. I could not tell you which leg now. I could not tell you how long ago. It was before I came to the road. He had been with the road a good many years. Engineer Riggs was the other man. I could not give the exact date, but he had been with the company for many years. He lost one kidney and was so aged that he could not see very well. He is retired since we put these gears on. From the time I went into the

service of the company up to the time that these two engineers made this request in 1929, I had not had any request from any of the other engineers to put power reverse gears on our engines. I have not had any since.

We expected these power reverse gears would speed up the service, but that did not prove true. We made a test on one of
1113 these gears, and it took about five seconds to reverse the engine, while an engineer under normal conditions could reverse the hand reverse in two and a half seconds. We have heavy switchers, seven, eight, and nine, weighing 146,000 pounds on drivers, equipped with Lewis power reverse gears. As to whether those are the engines they got from the Railroad Administration, they were equipped before I came to the road, and I assume the gears were installed when the engines were built. They were built by the American Locomotive Company.

The manually operated reverse gear is a piece of mechanism for the purpose of regulating the shut-off or the length of the stroke and the direction in which the wheels revolve. That is regulated as to the shut-off by moving a small lever. There are no valves in the manually-operated gear. There is a steam valve down in the cylinder. The manual reverse gear moves the valve gear. It is necessary for this valve gear to be lubricated. The valve gears have to be lubricated, whether operated by the power reverse or the manual reverse gear. It is always harder to handle the valve gear when the valves are dry, as compared with being properly lubricated. That is true of either the manual reverse or the power reverse (tes., pp. 3915–3925).

It is important that the valve gear should stay put where the engineer puts it in the operation of the train. After he has put it in one place, if it moves to another place without the engineer having moved it, that impairs the operation of the engine. The manually-operated lever pulls the valve gear in a fixed position. That is done by the quadrant, reverse lever dog, latch, proper springs connected to a reach rod, to the tumbling shaft, and the valve gears. The latch, or some people call it the dog, on the quadrant holds it in position. On the Norfolk & Southern that dog or latch is three inches wide, three teeth, fastened on front side of the reverse
1114 lever, with copper bolts and bridle rods. The teeth are approximately a half inch in depth and thickness. When that quadrant and dog are in proper condition, the operation of the engine or any of its parts will not cause the dog to jump out of the quadrant to my knowledge. I have never seen an occasion of that kind. A man of ordinary strength can operate this lever on the engines of the Norfolk Southern in the manually-operated reverse gears easily. This lever works in the cab. As to how our cab is as to room and convenience for the engineer to operate without striking any part of it or any part of himself in those movements, our engines have plenty of room between the reverse lever and the cab and other fixtures in the cab.

You state in the petition it is alleged that a manually operated reverse gear is inherently improper, unsuitable, and unsafe in principle and design. As to how that is in reference to those used on the Norfolk & Southern Railroad, I consider the reverse gears on our locomotives safe and adequate. You state in the petition it is alleged that the manually operated reverse gear is excessively heavy and difficult to use and is beyond the strength of many engineers to operate and it therefore subjects the engineer to undue fatigue and physical strain. As to how that is as to the manual reverse gear on the Norfolk Southern, we have had no complaint from our enginemen about being fatigued or over-exerted in our handling locomotives. They are unusually light gear on our heaviest engines, Walscheart piston valve. You state in the petition it is alleged that manually operated reverse gears and the various parts thereof frequently break a pin and cause the reverse lever to go out of control and strike the engineer with great force and severely injure him. Nothing of that kind has taken place on the Norfolk Southern to my knowledge. You state that in the petition it is alleged that the use of manually operated reverse levers frequently require the engineer and
1115 fireman to leave their usual and proper positions in the engine, to handle the said lever and place themselves in a hazardous position, and thereby prevents them from performing their other ordinary duties of keeping a lookout and taking signals. As to how that is on the Norfolk Southern, we have had no trouble in that respect, enginemen taking signals or observing signals.

Our other engines, except those which I have enumerated, are lighter in weight on the drivers.

While I was with the Seaboard I had a complaint made to me about a power reverse gear lever. At the request of one of the engineers, I rode his engine to ascertain the cause of the Alco power reverse gear creeping or vibrating. I found that it did creep. The crosshead moved backward and forward two to three inches, sometimes more. When the engine returned to the enginehouse, we worked on this gear. The movement of the crosshead caused the engine to pound badly and thereby he had to repeatedly adjust the hand lever. After I had ridden the engine and ascertained the cause, we examined the packing in the gear when I got back to the shop, and faced the valve in the power reverse. This improved the performance of the gear, but we never did get it to function as we wanted it. It still annoyed the engineer from creeping, so he said. As to whether I had any other personal experience with these reverse gears on other roads, on the New Haven I simply overhauled them in the shop, but I had nothing to do with their operation, except when the engine went out of the shop to see that it operated all right.

I said the power reverse gear put on these engines in 1930 was Alco. I have had no complaint about these three gears creeping, but since we were experimenting with these gears I had engine no. 226 pumped

up, put the power reverse in the forward gear, 90 pounds of air
1116 pressure, and took a 4-foot bar and pulled the gear to see whether it would yield, and we could pull the crosshead back one inch easily, with that air pressure in the cylinder.

"Q. As a machinist, knowing the operation of the engine, and so forth, what would that indicate as to their efficiency as compared with a manually operated reverse gear?

"A. The compressed air which holds the piston, which, of course, is attacted to the gear, yields if there is an uneven pressure on the valve gear in service."

These three engines with power reverse gears have been used largely in switching service. They are not hooked up so much as they would be in road service; they are worked near full gear, most of the time.

The power reverse gear is moved by compressed air. The air is pumped up. That air is regulated and controlled by a small lever in the cab. When the gear is functioning properly, that small lever not only reverses the engine but puts your valve gear in the position the engineer desires to work the engine. The small lever in the cab does not of itself move the reverse gear in a power operated reverse gear. It is compressed air that moves it. That small lever regulates or controls the compressed air by means of a valve. If an engine is put away, stopped, you would leave this small lever in the power reverse gear in center or neutral. The compressed air that was in the air chamber dies down, leaks away, after the engine stands long enough. When the air goes off the gear, the valve gear of the locomotive settles down to the bottom of the links. Much depends on the spring that regulates the gear. As a rule, that will go plumb down to the forward corner. It depends on the counter-balance spring, the way it is adjusted. It can be adjusted to such a point that it would not let the gear go entirely down, but for ordinary purposes it will let the gear fall plumb down to the links. In the Stephenson gear the link moves, and in the Walscheart gear the blocks
1117 move. The counter-balance spring on any locomotive would not hold the valve gear up in center to my knowledge. As to what effect this falling of the gear would have on the radius rod or any other part of that machinery, a small operating lever would stand in the position where it is latched. While the valve gear itself will drop down, so that the engine actually [will] be in the forward motion in the event someone gave the engine steam before the air was pumped up to make the power reverse effective, and the engine would move ahead, although the small lever is in the center or back motion. If the valve gear did settle down and you pump up the air, the reverse gear, and consequently the valve gear, seeks the position where it is left in the first place; as you pump up your air and increase the pressure, the gear itself will come right back into neutral position, as the small lever intends it should. If before it moved back to that neutral position the steam throttle was opened and the

engine was given steam, the engine would move forward notwithstanding that the hand lever indicates that it was in neutral and would not move. When the reverse gear has moved forward by reason of the air dying it has an effect on other parts of the reverse gear machinery, all the parts of the valve gear that are connected move. And then it would fall down as the reverse gear went forward. In pumping it up, while the pump was at work pumping up the air, and the air came in, and this reverse gear moved back to its neutral position, those same parts would move back again to their proper position. So that you would have that motion plus the air dying and being pumped up again (tes., pp. 3925–3935).

CROSS-EXAMINATION

As to whether, if you moved the manual reverse bar from the center down to the corner all the valve gear would move, with a Walscheart gear if you are on dead center there is one valve there which does not move, while the rest does move.

1118 By Mr. LAUGHLIN:

"Q. If someone moved the manually operated reverse bar, would or would not that move the same parts of the valve motion?

"A. Yes, sir."

If you picked it up from the corner and pulled it back to the center, the valve motion would come up, the same as with power.

All the power reverse equipment I know of would go to the corner if it was left hooked up, when the air died out or evaporated. Of course, I am not going to say all. I limit that to those we have on our road, and I have noticed that too on the Seaboard engines. You could overcome some of that by the proper adjustment of the spring, but not all of it. It impairs the gear for good operation when you tighten the spring too tight. I doubt that it could be overcome with proper adjustment on the counterbalance spring.

The name of the complaining Seaboard engineer is Mike Tye. He was in the Virginia division. I do not know whether he is still employed on the Seaboard.

Practically all of the engines on our road have a dog or latch that has three teeth on it. There are a few old engines in branch service which I do not believe have them, but all our heavy power that is handling our major business, we have installed this larger latch and dog. General improvement promoted us to put a stronger latch on. We had some trouble with the old latch; they wore. Where we had the latches made with just one tooth, they wore too rapidly and made the maintenance expensive, as well as the engine performing poorly. We found that our engines performed better when we kept the levers in good condition. We could keep our valve gear in a fixed position, and that, of course, gave us economical performance on our coal. Only one tooth in it caused the old style latch to wear. The natural vibration of the valve gear caused the

1119 tooth to wear. It did not necessarily have to be a heavy

weight resting on it, but just the natural movement of the valve gear. That dog is made of case hardened steel. We case harden them so that they won't wear so fast. The quadrant is made of soft steel. That is not case hardened. We do not case harden those. The teeth are not case hardened.

Under noraml conditions an engineer can handle the manually operated bar very easily. There may be cases when it cannot be handled easily—an engine just out of the shop or with all the fittings tight or excessive dry valves. Either one or all of those conditions would make the reverse lever handle harder than normally. As to whether dry valves would have a tendency to jerk the lever out of the quadrant or jerk on the lever hard, it increases the pull on the lever. It would not increase it sufficiently to jerk it out of the quadrant. With the latches we are using on the Norfolk Southern, you would have a hard time to pull those teeth out. We make those teeth nearly square.

"Q. Is that the reason you make them nearly square, so that that severe jerk will not pull them out of the quadrant?

"A. I do not think that is any different than the general practice."

If you make a tooth with too much rake or slant in it, of course, the normal pull of the valve would pull the lever, and, of course, that would be aggravated if your valves were dry. The strain on the reverse lever would not be great. I do not think it would be great enough to jerk an engineer if he happened to catch hold of the bar under those circumstances. If he was not braced at all, just sitting on his seat box, I do not think it would have any bad effect on him. In all of my varied experience it never came to my personal knowledge why an engineer had been injured by a manually operated reverse bar.

REDIRECT EXAMINATION

1120 I make reports as to the financial and traffic conditions on our road every month. In 1930 we failed to earn our fixed charges within about $230,000. That condition has continued since January 1st, and now we are $263,000 in the red, up to April 1st.

RECROSS-EXAMINATION

I have been making out reports on the financial conditions of the Norfolk Southern ever since I have been on the property. I went there in 1921. I cannot give you the net earnings of the company in 1921, but one of the items in which we lost the most, I can give it very close. In 1921 we were enjoying about $150,000 of passenger earnings per month, and now [our] passenger earnings run about $10,000 to $11,000 only. I would have to get the record to know what we were making from 1921 to 1929. I did not memorize those. We were losing money in some of those years from 1921 to 1929; in 1921 we surely must have lost money, because we had to devote a part of our salaries to make up a deficit. My memory does not serve me

well enough to tell you what the earnings or deficit of the Norfolk Southern were in any year except 1930. I cannot tell anything except about 1930 and the period 1931, up to April. I cannot remember anything now besides that (tes., pp. 3935–3944).

(Witness excused.)

HOWARD BOBBITT, age 55, of Norfolk, Va., employed by the Norfolk Southern Railroad as road foreman of engines, northern division, testified:

DIRECT EXAMINATION

I filled the position of machinist apprentice, Norfolk & Western Railroad, 1892, for four years. Fireman on the Norfolk & Western Railroad about eight months. Fireman on the Norfolk Southern Railroad about one year. Promoted to engineer. Remained in the service of the Norfolk Southern Railroad until 1905. Hired out to the Seaboard Air Line Railroad on the Virginia division as
1121 engineer. Employed by that company three years and two months as engineer. Returned to the Norfolk Southern Railroad in 1908. Ran an engine there until August 1913. Road foreman of engines thence up to the present time. Norfolk, Va., New Bern, N.C., Beaufort, N.C., to Goldsboro, N.C., and branch lines, north of that, four of them, constitute the northern division of the Norfolk Southern. That is approximately 430 miles.

The road foreman of engines reports to the superintendent, division superintendent and rides frequently upon the locomotives. He reports as to the economical use of fuel and other supplies, and obeys instructions of the superintendent of motive power pertaining to mechanical matters. Approximately 75 percent of my time is spent in riding the engines on the Norfolk Southern.

While I was engineer on these roads the engines which I operated were equipped with manual-reverse gears. I was never injured by one and have no personal knowledge of any other engineers being injured by one. Since I have become road foreman of engines on the Norfolk Southern, every trip I run the engines. I have not been injured by any of these manual reverse gears from time to time. I do not know of anybody that has.

We have a large, roomy cab on the Norfolk Southern, a seat box 14 by 26, good cushion, back-end seat, and as much as 23 inches from the reverse bar to the side of the cab. As to whether the reverse bar clears the boiler, from the reverse bar out to the cab you have got that much room in there, 23 inches. As to how these manual reverse gear levers on the Norfolk Southern on my division are as to being easy or hard to handle, I can handle one of them with one hand. It never causes me a bit of inconvenience to handle them.

About four engines in my district are equipped with power reverse levers. Two of them are used exclusively in switching service
1122 and two of them we use intermittently in road service. The two which are used exclusively in switch service are the 0–6–0

type, 146,000 pounds on drivers. They have the Lewis power reverse gear. I think those are the engines that we got from the Railroad Administration. They came there in 1919. I do not know who sent them there, or who they bought them from. The other two engines are equipped with the Alco gear. They have been on there about a year, the latter part of 1929 or the first part of 1930.

The reverse gear moves the valve gear. The valve gear needs lubricating at times. It galls the pins if you do not oil it. It gets dry. When it gets dry it takes more effort to handle. As to how the engineer learns when the valve gear in the manually operated reverse gear gets dry and needs additional lubrication, the lever rattles a little bit. Maybe the cylinders might groan a little bit. This reverse gear that is on the quadrant with a dog does not creep; it cannot creep. I have never known the latch to jump out of the quadrant unless someone lifted the latch. As to what I have to say as to whether manually operated reverse gears are inherently improper, unsuitable and unsafe in principle and design, they have been just like that ever since I have been knowing anything about a locomotive, and I never heard tell anybody being hurt with one. As to whether there is anything in the construction of the manual reverse gear levers on the Norfolk Southern Railroad which makes them excessively heavy and difficult to operate and beyond the capacity of an ordinary man to operate them, I can handle them all right. There is nothing in the construction or operation of these manually operated reverse gear levers on the Norfolk Southern which requires the engineer or fireman to leave his proper position in the engine cab in order to handle them. There is nothing in their construction or operation which prevents them from performing their necessary duties, including the observation of signals and keeping a proper lookout.

1123 These Alco power gears are on two engines. When those engines are put away and the pump stopped, the hand lever should be put in the center of the quadrant. I heard Mr. Adams' answer to the question as to what happens to the reverse gear as the air dies down or leaks out. I would not say that I agreed with Mr. Adams' answer. As to what happens to it, on a Stephenson link motion, we have Alco gear. The pumps are shut down, the engine put away, and all the air leaks away, and I have known of one case where the weight of the links would just go on down until the link block was on top of the link, and I myself started this pump up, and I had to jigger the lever before it would move the link. That is wherein I differ from Mr. Adams.

These Alco power reverse gears are not used generally in road service on the Norfolk Southern. As to whether I know anything about their creeping from their actual use in road service, on the Norfolk Southern Railroad I was never assigned as an engineer to an engine equipped with power reverse gear although I have rode on a good many engines in road service that were equipped with power reverse gear, and they all creep. As to what effect this

creeping has as to impairing the efficiency of the engine, it has a tendency to lower the link or valve motion in the direction of the engine, the way the engine is moving, and it is indicated by a stronger exhaust from the stack, and you fidget them to readjust them. I think with a precision, you grind the wheel around a little bit. It increases the amount of coal burned or used.

I have had occasion to ride engines on other railroads equipped with power reverse gears in order to study their operation. That was in May 1931. I could not say whether the use of the power reverse gears increased or decreased the capacity of the engineer for seeing signals. Everything was in plain view. The only thing I saw about the most of these locomotives which were
1124 equipped with Franklin Railway Precision power reverse was that they were very slow. In reversing the motion from one to the other, 16 turns of the wheel were required. That is a good deal longer than it takes with an Alco. The manually operated gear is the quickest as to reversing an engine.

CROSS-EXAMINATION

I have had experience in running engines in all service, from grease wiper up. Our passenger trains make about 45 miles an hour. I have handled the manual-reverse lever at that speed, and our engineers likewise have occasion to handle it. The heaviest engines we have in passenger service are 115,350 pounds on the drivers. Some are piston valve and some are slide valve. I have not observed any difference in the handling of the lever at that speed between a piston valve and a slide-valve engine (tes., pp. 3945–3955).

I have ridden on or operated these 168,000-pound engines. They are in freight service. We make around 35 miles an hour with those. I have had occasion to handle the lever at that speed, and the engineers do.

"Q. When you go to hook up or drop down an engine running at about that speed, do you do it with one hand, or do you take more than one hand?

"A. We can do it, but we have got them hooked up before we attain that speed."

I say we can, even at a higher speed than that. I say we do have occasions to handle the lever at that speed. When we get to bump, we let her down, and then let her up again. I do that with one hand. There is a little brace about as big as my foot on the deck. I use that in handling the lever; you can put your foot there. You brace yourself with that foot brace when you are riding along. I have observed engineers using two hands to handle the lever at that
1125 speed. As to whether that is the customary practice on my road, some of them do. I guess it is about equally divided. I use one hand when handling them. B. T. Jenkins, T. J. Toller, and D. F. Padgett, all of Norfolk, use one hand when handling them.

I have seen these fellows use two hands in handling the lever. I have seen them switch and back it up and take their shoulder, like this, and move it up a couple of notches, without putting their hand on it [indicating]. These men are in through-freight service. As to how you get the latch out of the quadrant when you bump it with your shoulder, all you have go to do is to shove it up. That is in shifting it either way you want. For instance, if a man is going back, and she is getting to go too fast, just take your shoulder and hook it up a notch. He lifts the latch with his shoulder. It is on the back side of the reverse bar. That is while switching around, setting off and picking up a car. The lever works the same way when you are on the road, traveling along. I do it that way when I am traveling along. It is not necessary for him to use any hands on the lever unless he wants to. You could not do it going ahead in switching, but just when you are backing up. If you start to put out a car, and she runs too fast, just bump it up a notch or two. As to whether, if you lift the latch with the lever in back motion, the counterbalance spring won't have a tendency to bring it forward anyhow, you know the tendency is for the valve motion to stay in the direction the engine is going, whether you had any counterbalance spring or not. When you give it the bump the lever won't go on further back because the tendency is for it to stay where it is at. It is just shoved out of the way.

As to whether I have observed any difference in the handling of the lever when I had dry valves, we do not have any of them. I have had that condition, but we have mechanical lubricators, and they are feeding all the time the engine is moving. I have had to handle
the lever when I have steam in the cylinders. It makes
1126 a little bit of difference in the handling of it. As to whether
I handle the lever when the counterbalance spring is out of adjustment, I never let them get out of adjustment. As to whether I ever had that happen, just when the engine comes out of the shop if she is a little bit heavy she at that time might do it when we are breaking her in. If the counterbalance spring broke while handling that lever, I think maybe it would give me a jerk if it broke when I had it unlatched. As to whether, if the strip on the slide-valve engine broke off and caught in the ports in handling an engine, that would give you a jerk, I never heard of one breaking, handling in the port, on a slide-valve engine, that is, a strip breaking. I think it might give you a jerk if you were handling the reverse lever when that happens. If some of the pins in the link block would bind while I was handling the lever, that would not jerk me.

I spoke about having to jiggle the lever to get the link block back on power reverse when it was being pumped up. As to what the air pressure was when I handled the lever, I tell you I could not say anything about that, because I had nobody to prove it by. I was there by myself and what I ought to have done was to let her pump up before I moved the reverse lever in the cab. But I did not

do it. I was in too big a hurry. The air pressure was about 35 pounds when I did move the lever.

I said I rode on a good many engines equipped with power reverse and that they all crept. I include in that answer several engines on the Seaboard Air Line and several on the Norfolk & Western. I do not know how many on the Seaboard. There were one-half dozen or more. It is my testimony that each one of those engines crept. Some more than others, but you have got to keep jiggling with the wheel.

By creeping, I mean any motion at all. They don't stay put.
1127 That is what I mean by creeping. I include turning the wheel in my answer about creeping. On this engine equipped with Precision the creeping was only a short amount.

"Q. About a half inch or three-quarters of an inch on the cross-head?"

"A. The indicator on it would show you."

My instructions when I went to ride these foreign engines were to go over there and learn would [what] I could about the power reverse gear. I was not told about this case before I did that. I knew that this case was pending. That is not why I went to ride on these engines. I went there because Mr. Adams told me to go. He did not tell me why I should go. He did not tell me that he wanted me to be a witness in this case, but I just surmised that somebody would want me, maybe.

I did not say that the reverse lever rattled in the notch as an indication of dry valves. I told you we did not have any dry valves. The lever rattles and the cylinders groan sometimes as an indication of dry valves. I know that by experience. I have had dry valves once in a while. When I said a while ago that we had never had dry valves, I mean we do not have any dry valves now, that the mechanical lubricator keeps feeding all the time the engine is in motion. I have had them in the past. I worked in a bad water district.

None of my engineers has reported any condition about the manual reverse gear to me. I have reported them myself, where the pins and stuff would become a little bit worn, you know we would have them remedied. No one has ever complained to me about the condition of the manual reverse.

I made a statement that when the air leaked off or evaporated on an engine equipped with Stephenson motion, that the links went down automatically, the block was on the top of the links, in other words, the motion was in full forward gear. Then I started the pump up and the links did not come back up until I
1128 manipulated the bar. I heard Mr. Adams make the statement that the links would come back up when air was pumped up. That was the reason I stated I did not agree with him that far. I do not mean his statement was in error. I mean just what I said, that the link fell down, and until I had fidgeted that bar, it would stay there. I mean that they did not come back up this time, and that is the only experience I have had of that kind. At the time

I threw the lever I had 35 pounds of air. As to whether if I had let the air pressure pump up it might have come back, I admitted I was in too big a hurry in doing that thing. I was in too big a hurry, and I should have called a witness but it was in the nighttime.

(Witness excused.)

FRANK T. SUMNER, age 43, of Raleigh, N.C., employed by the Norfolk Southern Railroad as road foreman of engines, western division, testified:

DIRECT EXAMINATION

I have been road foreman of engines since May 1st, 1918. Before that I had two years as a hostler helper and locomotive fireman on the Norfolk & Portsmouth Belt Line; one year as a fireman on the New Haven; one year as a fireman on the Southern Railway; and the balance of the time I was fireman and locomotive engineer on the Norfolk Southern (tes., pp. 3955–3967).

(Witness excused.)

July 1, 1931

J. E. BAKER, age 49, weight 210, of Hagerstown, employed by the Western Maryland as engineer, testified:

DIRECT EXAMINATION

I was first employed by the Western Maryland in 1903, braking.

I became a fireman in 1905 and was promoted in 1910. I
1129 have had experience with power reverse gear. I have had an unusual experience with an engine equipped with power reverse gears. It occurred at Hagerstown roundhouse. I do not know what the date was, but I know it was around 1 o'clock at night, in the year 1922. It was in April, but I do not know just what date it was. There was a colored man firing this engine up. I came from lunch about 1 o'clock and got on the engine to see how the colored fellow was coming on with it. After I got on it a few minutes, it started to move off, and the colored fellow went to get a piece of wood to put under the wheel and stop it. I seen there was no air on the engine, and I got up and started the air pumps, and before I got the air pumps started to get air the tank went in the turntable pit and knocked the house off of the turntable. The operating lever was not moved; I never touched it. If that engine had been equipped with a hand reverse gear, I would have been able to have stopped it. Nobody was injured when my engine went into the pit. The engine number was 925. If the man who was operating the turntable had not got out of the box, he would have been killed, because it was all mashed to pieces.

(Witness excused.)

H. E. CARRYER, age 59, of Hagerstown, Md., weight 200 pounds, employed by the Western Maryland as machinist helper, testified:

DIRECT EXAMINATION

I was employed by the Western Maryland in 1926 as a hostler. I had an unusual occurrence on June 10, 1926. This occurrence happened on what is called the Circle Track at the roundhouse at the Hagerstown, Md., Terminal. The engine was no. 801. I was supposed to stop the engine so that they could do the run and the machinist, I think, was taking a rest. I got up on the engine to move the engine and I found there was no steam on it of any account, maybe 40 or 45 pounds of steam. I could not operate
1130 the air pump to get any air out of the power reverse, with that amount of steam, and I started to open the stoker valve on the engine, and started the stoker to get some fire in it in order to get some steam on it, and as I opened the stoker valve, or about the time I opened it, the engine moved a little bit. The machinist go a chuck and put under it and got it stalled down, and I started to get some steam. I judge maybe I had 90 pounds or 100 pounds of steam maybe, and maybe not quite that much. I just cannot recollect exactly what the pounds were. Anyhow, I made an attempt, or did get the throttle valve open. When I opened the throttle valve, I thought it was the air pump which started and in place of the air pump the engine moved and run over the chucks. I mean the throttle valve to the air pump. When I opened the throttle valve to the air pump, the first stroke of the pump makes a kind of jerk, and I thought it was the pump which started, and in place of that—I was up in the cab on the rack in the cab—and in place of it being the pump started, it was the engine which started to move off, and went over this chuck. I did not have the air pump started, did not have any air, did not have no way of doing anything. The power reverse was setting in forward motion. The engine was headed toward the turntable pit. The only thing I could do was to get down on the ground and watch it go in the pit. If that engine had been equipped with a hand reverse, I would have been able to stop it. I do not know the type of power reverse with which the engine was equipped.

CROSS-EXAMINATION

The steam throttle was closed. When the engine made the first move, when I opened the stoker valve, the engine made the first move, and it only had a little bit of steam, and I went to the steam throttle of the engine and it was shut tight. I made sure it
1131 was shut, because I pushed on it to see if it was shut. As to what made the engine move, it evidently took steam to make it move, but why it did that, or where it got it from, I do not know. Nobody moved the throttle; nobody on the engine but me. I do not know whether the throttle was leaking or not. I did not accidentally

touch the throttle; the only thing I did to the throttle was shove on it when the engine started to move the first time and I went over to the throttle to make sure it was shut. As to the position of the track, there might have been a little incline toward the turntable but a very little. I could not tell you what kind of chuck was put under it. The machinist put the chuck under it. It was only a small pine chuck, but I could not say about that. After the engine moved the second time, it went right on and went into the turntable pit. It was going forward, head first. Nobody was injured. The reverse lever was in forward motion. The throttle was closed on that engine. I know that because I looked at it. I judge there was around 100 pounds steam on the engine. I could not tell you whether the throttle was leaking. The drafting valve might have been open, and that would have started it. I could not say whether that was open. I did not look at it. The reverse lever in the quadrant was in back motion. The engine moved backward.

(Witness excused.)

E. A. CHASHMAN, age 46, of Hagerstown, Md., employed by the Western Maryland as general foreman, testified:

DIRECT EXAMINATION

I was first employed by the Western Maryland in 1922 as roundhouse foreman. Prior to that I had experience with the Philadelphia & Reading Railroad from 1901, as machinist, air-brake inspector, stoker inspector, and assistant foreman. I came from the Philadelphia & Reading to the Western Maryland. I heard the testimony of Mr. Carryer with regard to the locomotive going
1132 into the turntable pit on June 10, 1926. I made an investigation of the damage done to the engine and the pit. My estimate of the damage to the locomotive and pit was about $1,200.

I had occasion approximately in June or July of 1927 to go out on the road and repair a power reverse gear on a locomotive. I do not recall the engine number exactly. It was either 1111 or 1114. I cannot say exactly which one it was, because both just about that time came in there. I received a call at home in the evening from the chief dispatcher that they were having trouble with this engine, either 1111 or 1114, I am not positive now which one it was. The engine was out there on the road and they could not get the air reverse working. There [they] were at a point probably 17 or 18 miles away from the terminal. They got me on the line and I talked to the engineer and tried to tell him what to do, and he told me he had done what I told him. The engine was stopped at the coal chute and could not get away. That was a freight train, about 100 cars. I got an automobile and went to this point, Big Pool, and found the air reverse was stuck and could not move it in any way, shape, or form. We got a couple of boards, and got up and tried to find out what was wrong, and I found one worm in the gear was

galled. It was a Barco air reverse with a worm and sector, which was galled and would not move. I took it apart, filed and cleaned it out, and shaped it up the best I could at that point, and replaced it, filled it with grease, and he was able to go on and make his run. I would say it took me about two or two hours and a half from the time I started until I finished (test., pp. 3968–3980).

CROSS-EXAMINATION

At some time or other there are different parts of a locomotive which go wrong. As to whether there is nothing remarkable about the power reverse becoming inoperative, it is something that we have to repair quite often. As to whether I ever had that
1133 experience before, that is the only time I had to go out on the road and make any repairs personally. Ordinarily, I send men out to do that kind of work. As to whether I have made a specialty of air reserves, I am not a specialist on anything, but I have worked on air reverses for a number of years previous to becoming foreman. The reason I went out was not that I have had more experience with the air reverse than any of my men. The reason I went out was I could not get in touch with anybody and did not want to have the railroad tied up. As to whether I would do that if the air pump went wrong, it did not make any difference what went wrong I would go out if it was a question of getting them away. As to whether this galling I spoke of could be caused by an excessive strain on the mechanism by the valve gear, as a general rule it is caused by the two parts not getting the proper lubrication. I have never seen any caused by strain.

REDIRECT EXAMINATION

I was asked if I did not find that the other parts of the locomotive occasionally got out of proper condition. I find that we have more trouble and more work done on the power reverse than we do on the hand gear.

(Witness excused.)

J. H. Barker, age 42, weight 185, of Elkins, W.Va., employed by the Western Maryland Railroad as engineer, testified:

DIRECT EXAMINATION

I was first employed by the Western Maryland in 1907 as a fireman. I was promoted in 1913. Since 1913 I have run more or less continuously as an engineer. I have had experience in all classes of yard, freight and passenger service. My present run is a freight run. I have had experience with both hand and power reverse.

I first operated a power reverse gear about 1915. Since
1134 1915 I would say about 75 percent of my time has been spent

operating hand reverse and 25 percent power. I have had experience with the Ragonnet and Pittsburgh power reverse gears.

I have never been injured with a hand reverse or seen anyone injured. I have handled locomotives equipped with hand reverse ranging from 70,000 to 217,500 [pounds] on drivers, and those equipped with hand [power] reverse ranging from 195,200 to 451,800. In my experience as an engineer, I find it very easy to handle the hand reverse gear. Customarily I handle the hand lever with one hand. We do not have any foot brace on our engines. We have plenty of clearance in the cab around the reverse lever. My physical condition at the end of a day's work with a hand reverse lever is very good.

I have had trouble on about one occasion, as I remember it, with a power reverse gear freezing. We were on a local freight turn running between Elkins and Durbin, and we had stopped at a place called Bowden to unload local freight, and while we were unloading freight there, I detected that the air reverse had frozen up. I found it necessary to get oil and waste and build a fire under it and thaw it out. That involved a delay in a certain way, but there was no delay turned in on account of the fact that we were unloading local freight, and while they were doing that, I thawed the reversing lever out. It did involve a delay.

I have had occasion to help hold a train on a hill on a descending grade with a hand reverse to assist the brake on account of the engine working steam through a stuck throttle. I assisted in holding the train on that hill by putting the engine in backward motion.

CROSS-EXAMINATION

The weights on drivers of the engines I handled in the yard I judge ran between 70,000 and 128,500. As to the weights of the engines I had in freight service which were manually oper-
1135 ated, I have given you a class there ranging from 70,000 up to 217,500. I judge between 14 and 15 years of my experience has been in freight service. I cannot just state how much of that time I was running these 217,000 pound engines. I was on the extra board quite a while, and you ran all classes. I could not state just how much. First, you are on yard engines and then freight engines, and I do not know just exactly how much. I have not noticed so much difference in the handling of the reverse lever on the 70,000 pound yard engine and on the 217,000 pound freight engine. Some of the larger engines are equipped with piston valves and the smaller ones with slide valves and some of them are not. I do not see any difference in handling an engine equipped with piston as compared with a slide valve engine. I do not have any more trouble lubricating the slide valves than I do the piston valves, not to a certain extent. By "to a certain extent" I mean the piston valve requires more lubrication than a slide valve.

I have had some dry valves; not very much. Ordinarily when my engine has dry valves the lever does not handle harder than it does ordinarily. As to whether it is about the same, it is just a kind of jerk. The bar jerks a little. That is not when I am handling the bar running over the road. You just see the bar jerk. If I am handling the bar, I do not notice the dry valves at all. As to whether there are any conditions when the hand operated lever works harder than others, there is a condition when the engine is not working steam that you could move it a little easier but not much. When the engine is working steam there are not necessarily any conditions over the road which makes it work harder than others. I have never had counterbalance springs out of adjustment. That would make a difference in handling the lever. I had one break. That is all. You could not reverse her and work the steam on her.

1136 On these occasions when I helped hold the engine with a manual reverse bar, I simply reversed the engine. If I had had power reverse on those engines, possibly I could have done the same thing, but not as quickly. With power reverse I judge it takes from about three to five seconds to throw an engine over. I judge about a half or one-third with a manual. That would be the only difference so far as I know. I am not a member of either of the engine-service brotherhoods (tes., pp. 3980–3990).

I told of the power reverse freezing up. I have worked on an engine with a manual reverse bar when it has been as cold as that. That would not make any difference in the handling of the lever so far as I know. So far as I am concerned, I could not tell any difference. As a general thing, I always open up the oil holes on the engine and see that the oil cups are opened up properly in connection with the lubricator before starting out on a trip. I always do that in cold weather. Cold weather has an effect upon the lubricating oil. What effect it will have depends on what kind of oil you are using. If it is heavy oil, it won't lubricate. If you thin it down so that it will go into the holes, it will lubricate then. Cold weather does not have any effect on the lubricating oil I use. If it is real cold weather, I thin it down, and it is coal oil or something like that. I have not noticed any difference in the handling of a manual reverse from any weather conditions or lack of lubrication.

I have been an engineer since 1913. I was not on manual reverse engines entirely for two years, and since then 75 percent of them are manual levers; just judging the manual lever with the power reverse in that time. I did not run all power reverse at that time. In the first two years it was manual bar and power reverse. Since that time as an average I have been 75 percent of my time with manual bars and 25 percent with the power reverse. During that time

1137 I have had difficulty a few times on an engine that I have had to report on my work report with respect to a manual bar, such as the latch spring being weak. That is about all. The bridles, that is, being loose and making noise. That is all I have reported.

I know there might have been a couple of times that I reported a loose dog. I have never had a quadrant out of adjustment that I know of. I have had the notches in the quadrant in which the latch or dog drops worn a few times. I have reported that on account of the bar maybe slipping down a notch or two notches. I have had that happen. I have never had it slip out and go to the corner.

REDIRECT EXAMINATION

I stated that on one occasion I had the equalizing spring break. I finished the trip with that engine.

(Witness excused.)

WALTER E. BUTLER, age 47, of Baltimore, Md., weight 198, employed by the Western Maryland as engineer, testified:

DIRECT EXAMINATION

My first railroad experience was not with the Western Maryland. I hired out to the Delaware & Hudson in 1900 as a brakeman, promoted to a fireman in 1902; promoted to an engineer in 1906. I resigned in 1906 and went with the Lehigh Valley as a fireman. I was promoted on that road in 1921. I did not remain as a locomotive engineer on the Lehigh Valley. I only run about three months. I then occupied the position of traveling fireman. I came with the Western Maryland in 1925.

I have had experience with locomotives equipped with hand reverse and also power reverse. I first operated a power reverse in 1921, for myself. Since 1921 I have operated mostly hand reverse up until 1927. From 1927 until April 1931, power reverse altogether. From April 1931 until the present time, hand reverse

1138 The range of weights on drivers of the locomotives I have handled equipped with hand reverse is from 70,000 to 217,500; and those equipped with power reverse, 217,000 to 459,900.

I have had experience in freight and yard service. My present service is yard.

I have never had an accident from a hand reverse and have never seen such an accident. I have never had the hand lever become unlatched of its own accord and go to the corner. I have never had it get away from me while I was handling it. I have never had a hand lever thrash back and forth over center. I have had plenty of clearance on those locomotives which I have operated equipped with hand reverse. I am a pretty good sized man. I have no difficulty whatsoever in handling a hand reverse. As to what has been my experience as to my ability to observe signals in yard service, I never [move] the bar until I get the signal. I do not know which way I am going until I get the signal, and the bar generally stands whichever way you are going until you move the bar.

My seniority rights entitle me to operate an engine equipped with power reverse.

The hand reverse may be moved from full forward to full backward position in an instant or a second, and the power reverse takes from five to nineteen seconds. You can swing a hand reverse in emergency faster than you would ordinarily swing it. You cannot make an emergency movement of the power reverse. The power reverse takes its own time. Some of them move quicker than others, according to how the valve works. The hand reverse, the movement of your arm moves the bar.

My condition at the end of a day's work with a hand reverse is 100 percent. My experience has been that you can maintain a very rigid point of cut-off with a hand reverse, and you can maintain the cut-off which you wish with the hand reverse. As to my experience in that respect with regard to power reverse, power
1139 reverse creeps, annoys you, tires you out. That creeping has an effect on the economical operation. It consumes more coal, more water and more lubrication. As to how I know it consumes more coal and water, I had my engine equipped with a back pressure gauge, and I run an 800 steady to define the difference. The engine was equipped with a back pressure gauge which told me what my engine was doing at all times.

While operating a freight train over the road, I have hung up on the hill due to lost motion of the power reverse gear. I had to double my train at the top of the hill. That involved a delay of about an hour.

One time I was oiling an engine equipped with power reverse gear and the mechanism of the valve gear moved. I do not know what made it move. It naturally moved itself. There was nobody around it. I do not know what made the valve gear move. No one was in the cab. The power reverse gear moved. I could not say whether it moved the link block or not, but I know the power reverse gear moved. I could not see whether the link block moved or not. It might have been a motion of the power reverse without moving the link block (tes., pp. 3990–4000).

I have had a recent experience of an unusual nature on an engine equipped with a hand reverse gear. Last Friday afternoon, I guess it was, I had 11 loads of slag, and three idlers, loading a barge. They had bled the air off, after I pulled up off the barge, and pulled through two sets of cross-overs, gave me a signal to shove the cars down in the yard, because they wanted to shove them off, and I started ahead, and three or four cars went over the switch, and my idler went out of the line, climbed the point, and I throwed the reverse bar over and got only one car off the track. I had steam in my cylinders, and it did not take very long to stop. If I had not
1140 pulled that hand bar in emergency, I would have went forward.

It is my opinion that if that engine had been equipped with a power reverse gear I would have went forward. I could not have

got it over so quick; there would be two or three seconds difference.

I look over my engine before I go out.

"Q. Are you able to adequately to various parts of the hand reverse gear?

"A. Yes, sir."

It is right in front of you and you can see it all. As to the power reverse gear, it is impossible because you cannot see it. There are some concealed parts.

My customary method of moving the hand reverse gear is with one hand, the other hand resting on the window sill, the same as my arm is now [indicating]. As to whether I find it necessary to brace myself in order to do that, I have no way to brace myself, unless I put my feet on the boiler some way. Sometimes I do that. I do not say I do not put my foot there. If the throttle is open and she will take the slack that way, I will put my foot on the boiler to do it. No man can reverse a power reverse engine with the throttle open, with one hand, without doing such. As to the relative economy of operation between a hand reverse and a power reverse gear. the hand reverse is the most economical as to consumption of fuel. In emergency cases the hand reverse is the safer.

CROSS-EXAMINATION

On the occasion that I used the hand bar to help stop my engine, I was using steam and had my throttle open. As to how far I had to move, I was giving the train a kick. I do not know how far I would go until they gave me a stop signal, but I had moved about five car lengths. My reversing my engine when I applied my brakes assisted me in stopping. My wheels continued to revolve on that occasion; they will, if you have sand and have got a good rail.

1141 On the occasion where I had to double the hill because of lost motion, the lost motion was in the power reverse gear somewhere. I cannot tell you where. It allowed the link block to come out of the bottom of the link about three and a half inches, and I could not get it in the corner. That is not a part of the power reverse; the machinery on the valve gear. The power reverse controls it. The lost motion was in the power reverse. I cannot tell you whether it was a part of the power reverse. I know it was in the power reverse because there was no lost motion no place else. The power reverse crept. The lost motion in the power reverse caused my stalling. I could not get the link block in the corner. When I stopped and pushed it ahead, it went in the corner, but I could not get ahead because it took all I had. I am not in any position to explain to you just where lost motion could be in a power reverse to cause that. I am not an expert on power reverse gear because enclosed, and I could not tell you that. I know there was lost motion in the power reverse because my engine creeped and fluttered on the whole trip. I know it from the way my engine worked, the

steam exhaust on the engine and the indication of the back pressure gauge on the engine. As to whether I could not come to any conclusion as to where the lost motion was because it was closed, I did not inspect it but reported "examine power reverse for lost motion. Could not handle train." I know the lost motion was somewhere in the power reverse and that is why I reported "examine power reverse for lost motion." There was no lost motion to amount to anything in any of the valve mechanism. I could not say how long the power reverse had been in service. The Ragonnet power reverse is what I had. It is the only time I ever hung up a freight train on that division. What I call "lost motion" is in the joints; it might be joints or valves. I would not call creeping lost motion, the valve creeps. That is not lost motion. The lost motion on this
1142 occasion was some place in he power reverse mechanism. As to whether I mean that there was enough lost motion in the joints or bearings to cause that, I could not say whether it was the joints or bearings. It might have been in the mechanism inside of the power reverse. I cannot tell you what is in there which could have caused lost motion of that kind. I know what some of the power reverses are like. I have seen the inside of some of them. I do not know what is inside of that barrel or cylinder. There is an operating valve, but I do not know much about it, you understand. I know the piston comes out from in there and must go back in.

I said you cannot inspect air reverse mechanism. You can inspect the air brakes connected with the power reverse. As to whether you can get inside and see what it is like, you do not have to. You have your pressure pump and piston which tells you what you have. As to whether that will tell you whether the valve is all right, it tells you if you have the proper piston travel and proper pressure on your gauge.

I say the hand lever is more economical. I mean by that that you can set your valve at the proper cut-off at all times. It is rigid. It stays where you put it. I have never had the experience of the latch jumping out of the quadrant and dropping down. I did not notice the last witness say that he had had that experience. fixed. He can take hold of it and put it back where it belongs, put his hand on the latch to keep it from rattling, and it won't do it. If he did not do that and it came out of the quadrant and went down a notch or two, the cut-off would not remain fixed (tes., pp. 4000–4010).

As to how I find out about the coal consumption with the power reverse, we have to make an estimate of the coal at the end of each trip, and see the coal that has been consumed. We run on a different division and our coal is weighed at Harrisburg. We
1143 have some engines of the same class and weight equipped with the manual bar and with power reverse, but not in the same class of service.

"Q. On the same territory?

"A. In yard service we have them with power reverse and with the manual reverse."

Creeping does not bother you in yard service because you practically always have it in a certain position and do not hook them up the way you do over the road and they do not bother you so much. I do not think we have that same class and weight of engines in the same territory on the road. As to how I have made a comparison that a creeping power reverse is more wasteful than a manual bar, if I get an engine where my bar does not creep my valve gear does not creep and she runs along perfect I burn less coal, consume less water, do not get tired, and get over the road. When I get one which creeps, I pretty nearly empty the tank, get tired out, and there is a nerve strain in connection with the thing and I cannot overcome it. As to whether I have to go to the doctor on those occasions for my nerves, I have pretty strong nerves. As to whether my fuel consumption makes me tired as an engineer, the annoyance of running an engine when she is not running properly makes me tired. Improper consumption of coal makes me tired.

I have had a power reverse engine work properly. The coal consumption of an engine with a power reverse working properly and a manual reverse working properly is the same thing. I did not make a comparison of that, but I know they are the same, because you can set your valve on the two at a proper cut-off at all times when they are working properly. I have had an engine with a power reverse where on one trip it worked properly and on another trip, through the same territory, with the same service, it crept. That was in freight service between Hagerstown and Harrisburg.

1144 The engine when it ran with the power reverse working properly was engine no. 815. I could not say when I first got that engine. Our coal consumption, when the lever worked properly, between Hagerstown and Harrisburg would be about 11 tons with a tonnage on our train of 7,300. Those engines were stoker fired. I have a record of turning in my consumption of 11 tons on several trips that way. It was on my time ticket, but I do not keep a record [illegible] have any of those tickets with me. The company has them. They go to the office and we do not get them back. I could not remember the dates of any trip of that character. I would run along different dates in 1927 and 1928. I have had this same engine now with the same tonnage for some time when it crept. As to the dates, it was the same time. I run the engine steady, understand. I have had the same engine every trip. Our coal consumption would be 16 to 18 tons, and sometimes 20. Up as high as 20 tons, due solely to creeping. That was between 1927 and the latter part of 1928. I had the engine steady during that time. I could not fix a month in which I had that variation of coal consumption. I can tell who my fireman was. I had a regular fireman, J. F. Wollard. He fired for me for three and a half years. This record is a fuel-consumption record, which is shown on the time tickets at the end

of each trip. I could not say whether the train sheet would show the tonnage. As to what is a month of normal heavy business on our road, I could not say as to the business on the road. As to whether I was working regularly on engine no. 815 during July 1928, I run that engine from 1927 until the latter part of 1928 and did not lose a day. I was running regularly on the same engine, in the same territory, for three years and a half, and did not lose a day.

As to whether I said power reverse took from 5 to 19 seconds to operate, if they are working properly they will work around three seconds. If any improper adjustments are present, it takes
1145 longer. The manual reverse operates as quickly as you can pull your hand across. As to whether in my experience it has always moved that easily, under conditions they will not all work maybe quite the same. They won't work so easily with your link block improperly lubricated. It might be chafed a little bit, engine new out of the shop, or something like that, and a little tight. It don't take any longer to handle with a dry valve, but a dry valve makes an annoyance, but it won't take any longer to handle. It takes a little more effort to handle with dry valves. It does not take longer to handle it if the counterbalance spring is out of adjustment. It might take a little more effort. If it is out of adjustment and you pull it ahead, it takes a little more effort, and vice versa. When I have difficulties of that sort I do not have to use two hands. I have used two hands in handling the lever. That would not be altogether on account of the lever operating more difficult than usual. It would be your position in the cab. If I was standing up, like this, and got a signal to go ahead, I might take two hands and go ahead [indicating]; or if I was standing this way [indicating] and got a signal to go back, and I might take two hands. It depends on your position in the cab.

REDIRECT EXAMINATION

I have never had lost motion on an engine equipped with hand reverse. You state that Mr. Barker testified that on one occasion the hand lever dropped down one or two notches. As to whether I have had experience with it creeping on only one occasion or more than one occasion, on several occasions it would creep. On one occasion it hung me up. In the instance that Mr. Barker testified to, you could hook that lever back and correct that loss of cut-off. As to whether in the instance of creeping with power reverse you can hook it back and correct it, you might hook it back and
1146 correct it for an instant or so, until it starts to creep again, and it goes back in its former position.

I testified that this difference in coal consumption on these various trips was due entirely to a difference between engines that did not creep and engines that creep. I did not mean to make that statement regardless of the tonnage of the train. If you go light, they won't

use so much. I mean with the same tonnage train. A man running 20 or 30 cars won't consume as much as when running 150 (tes., pp. 4010–4020).

(Witness excused.)

July 29, 1931

E. L. LAMBERT, age 62, employed as secretary and general manager of the Pickens Railroad, testified:

DIRECT EXAMINATION

I have had about 30 years railroad experience, from operator on up to general manager. The Pickens Railroad runs from Easley, S.C., to Pickens, S.C. It is 9 miles long and we have one locomotive. The Pickens Railroad runs through a rolling country. We have several curves and several grades. The maximum grade is about 6 percent. We have just freight service on that road. The locomotive is a Baldwin, 6-wheel, pony-truck engine. It has a hand reverse and what we call the Southern valve motion. It has regular slide valves. The engine is not superheated. We haul an average of 2 cars a trip. Both of those cars may not be box cars, they may be box cars or gondolas or flat cars. We do not have a caboose. We operate that road six days a week. Our engineer is paid for 10 hours a day on duty but he will average about 5 hours a day. All of our work is performed in day light. We have a scheduled time leaving Pickens at 8 a.m. and return leaving Easley at 10 o'clock in the morning. Our engineer is supposed to report for work 30 minutes before the leaving time. He does practically nothing from the time he reports until he leaves.

The kind of seat box we have on our locomotive is just a seat which is hinged to the side of the cab and supported in front
1147 by an iron leg. It can be dropped down. I have operated that engine myself as engineer. The reverse lever is to the left, attached to the front end of the engine. There is plenty of clearance around the reverse lever with relation to the engineer's seat box. The reverse lever does not interfere at any time with the engineer getting to the appliances on the boiler head or to the brake valve. I almost always stand up when I reverse. Our regular engineer can reverse it sitting down. As to the amount of strength required to operate the reverse lever when hooking up the engine or dropping it down, it is not very heavy; it takes quite a good deal of strength to hook the engine up when she is running; sometimes if you just catch it right it comes up easy, but sometimes it is rather hard. When I am operating the engine, I never have to have assistance to operate the reverse lever. We have a foot brace on the engine and when reversing the engine to the back motion I always use it.

As to how much switching there is to be done on our road, we have the station at Pickens and one cotton mill. The cotton mill averages about 2 carloads of cotton a week and a carload of coal.

The one at Arial averages about 2 cars of coal a week and about 3 cars of cotton. At Pickens when we start out that switching is done in back-up and at Arial it is done going ahead. When I am operating the engine and performing that switching in the back-up movement, I stand up in the cab. I get the signals from the man on the ground to stop and go ahead when he is on the engineer's side, and when he is on the fireman's side the fireman gets it. I have never had any difficulty in getting these signals from the men on the ground and operating the reverse lever. When I am operating the engine I never miss any of those signals that I know of. I have no knowledge that the engineer has missed any of them.

I have never had any difficulty with the reverse lever
1148 jumping out of the quadrant. It never got away from me.

I have never had any experience with its threshing backward and forward in the quadrant. We never have any trouble in my territory with water foaming.

Our engineer has never been injured within the past 5 years by the operation of the manually operated reverse gear. I have never been injured by the operation of a manually operated reverse gear while operating the engine. I have never been called upon to relieve our engineer from duty on account of exertion due to the operation of the reverse gear. I have always been able to operate it when I was on the engine without any relief. The operation of the manual reverse lever of our engine never subjected me to physical fatigue. I have never had the reverse lever to break with me.

CROSS-EXAMINATION

We pay our engineer by the month, and he is supposed to be at call for 10 hours. He is on duty 10 hours about half of the time. He goes and comes. Our engine lays up at the station, and if he wants off, he goes along and says, "I am going off, there is nothing to do", so he just goes ahead. As to whether he works continuously for 5½ hours and we pay him for 10 hours, sometimes we won't have a single car when we start out, and all he has to do is to go into Arial, and if there is nothing there he goes on to Easley. Then he waits there until the local comes in, and if he happens to get anything, which is very lucky, he will start back, and if he makes the trip back to Pickens in 40 minutes he is all through. As to what his actual time on duty is, he leaves at 8 o'clock. He gets around there between 7:30 and 8. He runs over to Easley, and if he gets out of there at 10 o'clock, it takes him about 45 minutes to get back to Pickens, and then they bank the fire and he is through. That means

that he has been on duty about 3 hours. We pay him for 10
1149 hours. We pay him by the month. That establishes a call for

10 hours, and he does what he has to do usually in about 5 hours. As a normal thing he is through with his work in 5 or 5½ hours.

(Witness excused.)

B. B. WILSON, age 37, weight 220 pounds, employed by the Lawndale Railway & Industrial Company as engineer, testified:

DIRECT EXAMINATION

I have been running as an engineer since 1917. All my service has been with the Lawndale Railway & Industrial Company. I have had experience as an engineer in freight and mixed service. I have freight service on that road at the present time. The termini of that road are Lawndale and Shelby, N.C. The territory through which that road runs is kind of hilly. I use the 2–8–0 type of locomotive, operated with hand reverse gear. It has the slide, Stephenson, valve motion. We haul 5 to 6 cars to a train. I have very little switching to do. As to how much time per day is put in in switching, we go on duty at 7 o'clock and leave about 8:30, and get to Shelby at 10 o'clock and have 2 or 3 switches to make between that time, I suppose. Then I don't move any more until one o'clock. I suppose 3 switches will make up a train. It takes 30 minutes to do that. We run 3 days per week. I am on duty 10 hours per day. We have a scheduled leaving time. I do not have to report for work before leaving time, I don't go until 7 o'clock (4024–4034).

The seat box we have is a stationary box. The reverse lever is on the left-hand side of the box, between the box and the boiler. The clearance is all right around the reverse lever in relation to the engineer's seat box. The reverse lever does not interfere with my getting to any of the instruments on the boiler head. It does not interfere with my getting to the brake drive in any way.

1150 When I am operating the reverse lever I occupy the engineer's seat box. I don't know about the amount of strength necessary to move the reverse lever in hooking up the engine or dropping it down. It does not give me any trouble to do it with one hand. I can operate it with one hand. I am able at all times to operate the reverse lever without assistance. I have a foot brace on one engine. Sometimes I use the foot brace and sometimes I don't. I do not have any block signals to observe. As to whether I have any railroad or highway crossings to observe, one is the railroad crossing and four State highways, I believe.

The switching that I do in a back-up movement is about equal to the forward, I guess. As to what position I take in the cab on a back-up switching movement, I can stand or I can sit on the seat box, it doesn't make any difference. Sometimes I do one and sometimes the other. When I am doing that back-up switching I get the signals from the men on the ground to stop or go ahead. I have no difficulty in getting those signals and operating the reverse lever. I have never missed any of those signals; if I do I wait until I get one. I have never had any accidents due to my inability to pay attention to the men on the ground in reversing the engine. I have never had the hand reverse lever jump out of the quadrant with me. It has never gotten away from me. I have never had any difficulty

with it threshing back and forward on the quadrant. I have never had any difficulty with foaming water in my territory; good water. I have never had any difficulty in clearing my cylinders of steam when necessary. I have never been injured while operating the manually operated reverse lever. I have never had to be relieved from duty on account of the exertion due to the operation of the manually operated reverse lever. The use of the manual reverse gear on the engine I operate does not subject me to undue fatigue and physical strength. I have never had a manually operated reverse lever break with me. I have never been prevented from keep-
1151 ing an effective look-out by reason of my operation of the manually operated reverse lever. I am a member of the brotherhoods that are complainants in this case.

CROSS-EXAMINATION

If I want to use the foot brace in handling the manual lever I do use it, and if I don't want to use it I don't use it. As to what are the circumstances when I do use it, I just use it, that's all. We have one engine that hasn't that on, that does not have a foot brace, and when I am running that engine I don't miss it at all. I do not have occasions when the lever works harder than usual, my lever works good. I have never noticed any variation to amount to much in the amount of strength required or the way the lever operated. It is always in perfect condition, the mechanic keeps it up in good shape, and it does not give me any trouble. As to how often the mechanic examines it, it is repaired about every 2 weeks, it goes in for repairs and they wash the boiler and make inspection. I never have any difficulty with the reverse lever. I have never had any experience with my valve getting a little dry; I have a good lubricator and keep it lubricated. I don't think I have ever had dry valves. My testimony is that I have never had dry valves. I have never noticed any variation in the strength of the counterbalance spring. There has not been any variation in the operation of the lever. I have had an engine that has been recently overhauled. I have handled the engine directly after that has been done. The lever does not handle any harder under those conditions than it does after it is broken in; that is fixed by the mechanic before he turns it over (tes., pp. 4034–4043).

(Witness excused.)

G. L. Cotton, superintendent of the Carolina Western Railroad, testified:

1152 DIRECT EXAMINATION

My railroad experience has been all my life. I have had experience as an engineer on the Norfolk Southern, Wellington & Powellsville, and the Georgetown & Western. I have run an engine on the

Carolina Western. We have freight service on the Carolina Western. The road runs between Halls, S.C., and St. Stevens, S.C., all flat territory. We have the Prairie type of locomotives, 2–6–2 wheel arangement, Stephenson valve motion. We haul five to seven cars in our trains. We have switching to do on that road. Two and a half to three hours per day, five days per week, is occupied by the engineer in switching. The engineer is on duty 12 hours per day. About 7 hours of that time is actually spent on the engine.

The seatbox on our engine is on the deck, back up against the back part of the cab. The reverse lever in relation to the seatbox is at the left hand side. The quadrant is nearly all forward of the box. There is plenty of clearance around the reverse lever with relation to the engineer's seatbox. When I was operating that engine I did not have any difficulty in getting to any of the instruments on the boilerhead or to the brake valve. When I was operating the reverse lever I operated it from the seatbox or standing up, one of the two. I stood to operate it in shifting, principally. We have a foot brace on there. I used it sometimes. We had a back-up switching movement. When operating in a back-up switching movement, the position I took in the cab was standing principally. I have observed our regular engineer in that service. The position he took in backing up was standing principally; it is more convenient.

I never had any difficulty in getting signals from the men on the ground, operating the reverse lever at the same time. I can't tell whether I ever missed any of those signals or not. If I did I
1153 waited until I got one before I moved. I have never had any accidents due to missing any of those signals. The reverse lever has never gotten away from me on those engines. I have never had any difficulty with the reverse lever threshing back and forward on the quadrant. I have never had any trouble with foaming water in my territory. I was never injured by the operation of the manually operated reverse gear. Our engineer was never injured in the operation of it. I have never had to relieve our engineer from duty on account of the work incident to the operation of that reverse lever. I have never had the manual reverse lever to break. Our engineer has never complained about the manually operated reverse lever requiring too much strength for him to operate. He has never asked that we put a power reverse gear on that engine.

CROSS-EXAMINATION

The engineer on our road has never reported the manual reverse for repairs. As to whether the reverse gear on our engine has ever been repaired, I don't know what you mean. We overhaul our engines and we usually do all that is to be done. If there is anything wrong with the latch we fix it. As to what repairs we do have occasion to make on the reverse gear, we don't have anything to do except bush it, or make a new pin for the bottom of the lever, running repairs, I would say. That is all that I know of. As to why

I referred to the latch a moment ago, when you use it a lot the lever will jump a little in the quadrant, but not sufficient to make it jump out. I think of that about jumping out because I heard the question asked just now. The only time I ever heard of a lever jumping out of the quadrant in my experience was when Mr. Miller talked to me about it. I have never heard from other employees on a railroad of the lever jumping out of the quadrant. I have been in the railroad business all my life, but I quit running engines a long time ago, although I run some now when my man is out. I
1154 haven't got an extra engineer. The latch on that locomotive has to be repaired when it wears, of course. As to what we do by way of repairs, we used to make a new one, or swell the end of it, make it fit the quadrant. If we don't make those repairs it doesn't have any effect on the operation of the lever. As to why we do it, it will jump backward and forward a little bit in the quadrant. That is all I have ever seen it do. I would say that is the only effect.

(Witness excused.)

F. W. WEBB, employed by the Gainesville Midland and the Gainesville Northwestern Railroads as master mechanic, testified:

DIRECT EXAMINATION

I have had 24 years railroad experience as a boilermaker and master mechanic. I have been with the Gainesville Midland and the Gainesville Northwestern 17 years. As to my duties as master mechanic, I have charge of all the motive power, also engineers, firemen, and shopmen. I said I have charge of the engine crews.

The territory through which those roads run is an agricultural country, hilly. The service rendered by those roads is freight service altogether. The locomotives on those roads are reversed by hand. We have the Stephenson valve motion on 4 and the Southern valve gear on 2. We have one slide valve and five piston valves. We haul anywhere from 6 to 10 or 12 cars as an average to a train on those roads. The Gainesville Northwestern operates 2 days a week at the present time, and the Gainesville Midland operates 6 days a week. Those operations are all nighttime. On the Gainesville Midland three of the locomotives are in service at one particular time. We have 2 scheduled runs and sometimes we have 3. We have two scheduled trains on these roads. Our engineers report for duty 30 minutes in advance of leaving time. They are required to oil around the engine, look the engine over, etc., before they leave.

1155 I have operated the reverse levers on these engines. The reverse lever is by the side of the boiler, located ahead of the engineer and to the left. On the average there is 3 inches clearance between the boiler and the reverse lever and 15 inches between the reverse lever and the cab. The reverse lever, with reference to the engineer's seat box, is on his left, forward. There is sufficient clear-

ance around the reverse lever in so far as the engineer's seat box is concerned. When the reverse is in the extreme back motion, the engineer has no difficulty in getting to the appliances on the boiler head. Our engineers have no difficulty in getting to the brake valves (tes., pp. 4043–4053).

I have had experience in operating engines equipped with both Stephenson link motion and slide valves on the one hand and the piston type of valves on the other. I don't think I have noticed any difference in the performance of the reverse lever on those engines. Our engineers operate the reverse lever from the seat box. The amount of strength necessary to move the reverse lever either in hooking up the engine or letting it down or reversing it all depends. When the engine is newly overhauled, new rings or new strips, whatever it might be, slide valves, naturally they are hard until you get them broke in. I weigh 154 pounds. As to whether I have ever had any difficulty in operating the reverse lever even after the engine had just been overhauled, I have to break the engine in before I do any service work, operate it myself. I have had to have assistance in doing that at the shops, but not after it went into service. We have foot braces on those engines. I don't think the engineers use them; I don't think I have a man that uses them. I have used them when I was operating the reverse lever.

There is no block signals to be observed on our line. We do on the average from two to four hours switching on the Gainesville Midland. We do very little on the Gainesville Northwestern,
1156 about 30 minutes. About 50 percent of the switching on the Gainesville Midland is done in a back-up switch movement. On one locomotive the engineers stand when performing service in that back-up switching movement; on the rest of them they use the seat box. We have not had any accidents resulting from their failure to get signals from the men on the ground in the back-up switch movement. I have switched the engine in that type of movement. I have never had any difficulty in getting the signals when operating the reverse lever.

I have never had any difficulty with the reverse lever jumping out of the quadrant. I have never known of any difficulty with the reverse lever in getting away from the engineers. We have not had a man injured by the reverse lever in my 7 years as master mechanic. Since I have been on the road, we have never had to relieve any engineer from duty on account of his operation of the manual reverse lever. They have never complained to me about operating the manual reverse lever being too hard a job.

We had one manual reverse lever or Johnson bar break on us four years ago, on an old passenger engine. It was in service on the road. There was no accident; the engineer happened to catch it, so he stopped. The reverse lever itself broke at the bottom about three inches from where it is fastened to the frame. The engineer was not injured in any way; it didn't cause any accident.

CROSS-EXAMINATION

As to whether I have ever operated an engine as an engineer, I have switched some. I have never regularly held rights as an engineer. My experience in handling is mainly around the shop and on the line of road. I have run quite a bit with the engineer, but of course he is in charge of the engine.

We have a form for the engineer to fill out as a daily work report.

1157 I have not had experience with receiving the work report relating to the reverse gear. As to whether I mean by that that the engineers never report any work to be done on the gear, they have reported that the reverse lever latch was worn, and things like that. I have had quadrants where the notches would be worn and the quadrant some, and the engineer would report it. He is supposed to make those light repairs, you know. Nothing else pertaining to the latch and quadrant. Possibly they would report the bolt or bushing or reach rod and lever. That would be reported as lost motion. I have had reports on the counterbalance spring being out of adjustment. I have had reports such as "reverse lever working hard", "hard to handle." As to what, in my experience, makes the reverse lever hard to handle, possibly the engineer neglects his lubrication; that is one of the main things. I have had reports where he would want more oil, and in order to get more oil he would say that the reverse lever is jumping. By "jumping" I mean the valves sticking to the walls, that would make the reverse lever quiver or jump. I don't mean jump out of the quadrant, but just noisy. There would be a tendency for it to jump out of the quadrant, where it is quivering or jumping like that, if it was not lubricated properly.

I said that on the average there is three-inch clearance between the boiler and the lever. I do not mean by that that there are some places on some of our engines with less than three-inch clearance. I was taking the average of my locomotives as a whole. Three inches is the closest clearance we have at any point. When the engine is in backward motion you might say it is six inches right above the engineer. We do not have any of them where the lever is alongside the seat box; mine are all forward.

As to whether there was any unusual conditions in the locomotive on the occasion when the reverse lever broke, we found no cause for it, it just broke. As to whether it was an old break, it was

1158 an old locomotive. This happened about four years ago. We found no cause why it should have broken. It was just one of those things that happened. As to whether it was a new break all the way across or whether there was a crack there, it just snapped off. The engineers claimed there had been no operating difficulty, valves sticking, or anything of that kind. Nothing happened. When this broke it didn't jump out of the quadrant, but the engineer saw it moving. I can't say right now whether he was

going backward or forward. He caught it, but it did not jump out of the quadrant.

(Witness excused.)

A. LESTER, superintendent of the Louisiana Southern Railroad, testified:

DIRECT EXAMINATION

I have been superintendent of the Louisiana Southern Railroad three years. I have been with that road 37 years as brakeman, switchman, yardmaster, trainmaster, chief clerk, superintendent. We have freight service on that road. The Louisiana Southern runs from New Orleans to Pointe-a-la-Hache, with a branch from Poydras to Shell Beach. The territory through which it runs is a flat country paralleling the Mississippi River, it is agricultural, and three industries at present all closed. We have two coal-burning locomotives and four oil burning. All six of those locomotives are reversed with hand gear. They have the slide valve motion. Two engines operate three days a week, and one operates six days a week. That one that operates six days is in the terminal. That is a switch engine. They are operated eight hours per day. One is a schedule run. On our line the engineer has to report 30 minutes before leaving time. Between the time he reports and the time he leaves he looks around his engine to see that it is in condition to go out (tes., pp. 4053–4063).

1159 The reverse lever of those engines is on the left-hand side of the engineer. There is about 12 inches space between the seatbox and the quadrant. The kind of seatbox the engines have is just a regular ordinary box, about three feet long and 14 inches wide and 12 inches high. They are stationary and cannot be dropped down. As to the clearances around the reverse lever with relation to the engineer's seat box, the engineer has enough clearance so that when he is in a backward switching motion he can reverse his position and use the reverse either backward or forward. I ride on the locomotives once a week, make a trip over the road. So far as my knowledge goes and so far as I have observed by riding on the engines, I would say the engineers have no difficulty whatsoever in getting to the appliances on the boiler head. They have no difficulty in reaching the brake valve. I have observed our engineers in the operation of the reverse lever. As to whether they operate it from the seat box, they never get off the seat box. I have not operated that reverse lever myself recently—back in the time when I was braking I did.

We have foot braces on our engines. I have never observed an engineer using the foot brace in the operation of the reverse lever. I have observed our engineers in back-up switching movement all day long when I was in yard service. They sit down when performing that service.

Our engineers have never complained to me or reported to me that the reverse levers jumped out of the quadrant. They have never reported to me that the reverse lever has gotten away from them while hooking up the engine or letting it down. As to whether they have ever reported to me that the reverse lever threshes to and fro in the quadrant, I will say that there is some lost motion at some time which is reported by the engineer to the master mechanic on his daily reports. We have trouble with foaming water in my
1160 territory occasionally when the Mississippi River gets very low. That has no effect whatsoever on the operation of the reverse lever. The only effect it has is that it causes the water to foam. I know it does not have any effect on the reverse lever from my experience in riding along; I never heard the engineers say that the salt water affected the engine except that it caused the water to foam, so he couldn't tell just what was on the gauge. It does not get salty enough to cause him any serious trouble.

So far as my knowledge goes, none of our engineers has ever been injured by the operation of manually operated reverse gears. I have never had to relieve an engineer from duty by reason of exertion due to the operation of the manual reverse gear. Our engineers have never asked us to have those engines equipped with power reverse gear. So far as my knowledge goes, the reverse lever has never broken on any one of these engines.

CROSS-EXAMINATION

The engineers make their daily reports to the master mechanic on the regular form. They come to another official. As to whether they may have trouble and I not know anything about it, the engine would not go out if they did. Whatever they put in their book in the way of repairs, the master mechanic notes them before the engine goes out. He is instructed to make them and he does. I know he always does it because the book is always o.k. before that engine goes out by the master mechanic. I follow the engine only to make a trip back in the shop every day. My office is right at the roundhouse. It is my testimony that the work is always done 100 percent when it is reported.

I can't say that I have ever had occasion to criticize an engineer for not getting the correct signal. An engineer has missed a signal when I was on the ground giving the signals to him. I would
1161 cuss him out then, that is about all. I would know that he missed it because the signal was not obeyed. I would give him a stop signal and he would ram into the cars, and I would know he was not obeying it. When he is working an engine he does not necessarily bring his head inside of the cab in order to do that. I have never known him to bring his head inside of the cab when he is handling the reverse lever—he might take his head inside when he is putting on his injector, but not when he is handling the reverse lever. As to how he would miss the signal, he might have to put

his head inside to put water in the injector. My experience though is that when he does put his head inside he does sometimes necessarily miss a signal.

When the engine is in the forward motion, the engineers just look over the side when they are observing the instrument, the water gauge, or something of that sort. They do not have to get up to look at them, it is right on the side. He has all the instruments right up there on the board. It is never necessary for them to stand up to get a look at those instruments or to handle them.

I said I have never seen an engineer use the foot braces when he was handling the lever. As to what is the purpose of those foot brace, I imagine if his engine is hard to handle he would get off the seat box and put his foot on the brace and throw it over. On the occasions when I have been riding the engines I have not observed that they were hard to handle. It might be possible when I was not on the engine that they do use the foot brace, but it never has been when I was on the engine.

(Witness excused.)

W. T. HARGETT, age 68, general manager of the Live Oak, Perry & Gulf Railroad, testified:

1162 DIRECT EXAMINATION

I have had 48 years railroad experience as section hand, section foreman, iron-gang foreman, work-train conductor, local-freight conductor, supervisor, roadmaster, superintendent, general manager, and president for eight years until the road changed hands a couple of years ago, and I was set back to general manager on account of change of ownership. All of my service was not with the Live Oak, Perry & Gulf Railroad—18 years with the Live Oak, Perry & Gulf, 26 years with the Atlantic Coast Line, 21 of which I was supervisor and road master, four years with the Gulf Lines Railroad, one as superintendent and two years as general manager.

We have mixed double daily service on the Live Oak, Perry & Gulf. We have one 4–4–0 locomotive and three known as 4–6–0. Three of them have the Walscheart valve gear, and two of them have the Stephenson valve gear. Those engines are all wood burning. As to how many days a week those engines are operated, of the freight runs, two local trains, two engines, six days a week. Ten to 11 hours a day is the engineers' schedule time, and if it is real heavy work they put in from 1 to 3 hours overtime, in other words, from 11 to 14 hours a day according to the work. As to how many engine crews we have, we have four engineers. Of course, we have two regular runs but we have two extra men.

I am familiar with the location of the reverse lever in the cabs of those engines. They are all manually reversed. The reverse lever with relation to the seat box is just to the left of the engineer, just a little forward from the middle of the seat. The clearance around

the reverse lever and with reference to the engineer's seat box is from 8 to 10 inches. Our engineers have never complained to me about the clearances being too small or close. Our engineers have never complained to me about having any difficulty in getting to the appliances on the boiler head. As to whether I have observed the engi-
1163 neers in the performance of their duties on my road, I ride with them quite often and see them every day on the line of the road. So far as my observation has gone and so far as my knowledge goes, they have no difficulty whatever in reaching the brake valve. They sit on the box and reverse those engines. They sit on the engineer's seat box when they are switching; you rarely ever see a man stand up (Tes., pp. 4063–4073).

I have never heard of any complaint about the reverse lever threshing backward and forward in the quadrant. I have never heard of the reverse levers getting away from our engineers while they were hooking up the engine or letting it down. I have never heard of any accidents on our road while I have been connected with it due to the failure of the engineer to get signals from the men on the ground in switch movements. So far as my knowledge goes, we have never had any engineers injured on our road by the operation of the manually operated reverse gears. We have never had to relieve an engineer from duty on account of exertion due to the operation of the manual reverse lever. None of our engineers has ever complained to me about the operation of the manual reverse gear requiring more strength than they have. So far as my knowledge goes a manually operated reverse lever has never broken on our road.

CROSS-EXAMINATION

If the engineers had any difficulty in operating the manual reverse lever, they would report to the master mechanic. I have never run as an engineer. Sometimes I ride an engine 30 days, and sometimes once or twice a week, no fixed time, just when I have occasion to do it.

"Q. It would be just a short distance that you would ride, between stations or stops?

"A. That is in my present position I speak of."

(Witness excused.)

1164 R. F. FEEHAN, age 40, employed by the Mississippi Export Railroad as master mechanic, testified:

DIRECT EXAMINATION

I have been on the Mississippi Export five years. I have been in the railroad business about 20 years as machinist, foreman, engine inspector, master mechanic, on the Southern Pacific, Illinois Central, Frisco, Gulf and Ship Island.

We have freight service on the Mississippi Export Railroad. That road runs between Pascagoula and Evanston, Miss., 42 miles. Two-thirds of the territory through which that railroad runs is marshy country and the other one-third is hilly. Our maximum grade is about 2 percent.

As master mechanic I have charge of the engine and train crews. We have three Consolidation 2–8–0 and one Mogul 2–6–0 locomotives. Three of those engines have hand reverse and one has a power reverse, but it is a reverse that we made in the shop, it is not factory made. The 2–8–0 Consolidation engine has the power reverse. I made that power reverse gear myself. These engines have Stephenson valves, slide valves. As to whether our crews have any switching to do, I do the switching in the afternoons. I go from Moss Point to Pascagoula, and if the business is slow we use a shop crew. I run the engine over there four miles, and then the train crew takes it from Moss Point. It takes about two hours to do the switching. While that switching is being done, I am the engineer on the train. I use one the the Consolidation 2–8–0 engines. Sometimes we have the hand reverse and sometimes the power reverse. Our engines work six days per week. We leave the shop at 2, the train crew comes on at 4. It takes the shop crew two hours to do the switching. Then when they get back depends on how long they remain at Evanston. They are generally on the road 8 to 10 hours. The engineer does not have any duties to perform prior to leaving on his run, the engine is ready.

1165 As to the location of the reverse lever on those engines with relation to the engineer's seat box, we have a drop seat with a clearance of about six inches between the seat and the quadrant, situated on the left-hand side about four or five inches clearance between the quadrant and the boiler. The boiler projects back in the cab. The reverse lever is to the left and forward of the seat box, the center of the quadrant is even with the engineer's seat. The reverse levers have about five or six inches clearances between the seat and the quadrant and the reverse gear. Those clearances are ample for my operation of the reverse lever. When the reverse lever is in the extreme back motion, I do not have any difficulty in getting to any of the appliances on the boiler head. As to what position I am in with relation to the quadrant when I reach for the brake valves, the brake valve is right in front of the engineer, situated to the left just a little. The release lever does not interfere with the engineer reaching that brake valve. When we are switching forward we operate the release lever from the seat box. When we are switching back we are generally seated on the window. We have a seat on the arm rest which you sit on in switching backwards. We just reverse our position in handling the engine.

When I am in a back-up switch movement I get the signals from the men on the ground. I do not have any difficulty in getting those signals and operating the reverse lever. I have never had the signals

changed on me while I was reversing the engine. As to whether I always look out for the signal after I reverse the engine and before I move when I am backing the engine, I don't have to change my position to reverse the engine. I have no difficulty in keeping my eye on the man on the ground.

I have never had any difficulty with the reverse lever jumping out of the quadrant; we always keep it in shape so it won't
1166 do that. None of my engineers has ever reported to me that the reverse lever jumped out of the quadrant. None of them has ever reported to me that the reverse lever got away from them while they were hooking up or letting down the engine. It has never got away from me under those circumstances. I have never experienced any difficulty with the reverse lever threshing back and forth on the quadrant. When I am operating the engine I never have to get assistance in operating the reverse lever. We have a foot brace on the quadrant. It is very seldom used. I never use it. We have no trouble whatever with foaming water in my territory. The temperature in my territory ranges up to about 90 or 92 in the summer, and in the winter it gets down to about 30 or 32 above zero.

I have never been injured by the operation of a manually operated reverse gear. Since I have been connected with the Mississippi Export we have had no engineers injured by that. I have never had to relieve an engineer from duty on account of the work incident to operating the reverse lever. None of our engineers has ever complained to me at any time about the operation of the reverse levers. When I am operating the engine the manually operated reverse gear does not require so much strength to operate as unduly to fatigue me. I don't get off my feet to reverse. When I have been operating the locomotives, I have never been prevented from keeping an effective lookout by reason of having to operate manual reverse lever (Tes., pp. 4073–4083).

CROSS-EXAMINATION

I have not had any work reports filed by our engineers relating to the reverse gear on this road since I have been there. I have never made any repairs or done any overhauling of the reverse gear. We occasionally will put on a new pin in the reach rod, or the link pin, or something of that sort. We do that when we are overhauling the engine. Occasionally we will build up the latch. Our engineers
1167 have never reported that the latch needs building up, I generally look after that myself. As to what it is that we find about the manually operated reverse apparatus that needs repairs, the latch is the thing that gets most of the wear. It is easily checked up. If you want the reverse lever to work properly the counterbalance spring has to have some attention. Generally it drops forward if it is not properly adjusted. That would make your reverse lever handle hard in backing up.

I do not have any reports from our engineers as to engines not lubricating properly. We have no cases of dry valves or improper lubrication of the valves whatever. As master mechanic I have never found any indication of dry valves on our engines since I have been on this road. I have had foaming engines, but not on this road. I have all slide valves on the engines under my jurisdiction. I have never found any indication of strips binding or any obstructions in the valves. I have never had any strips to break. Our engineers never report the reverse gear working hard, the lubricator, or anything of that sort. I have never had any difficulty at all with manual reverse gears on this road.

As to the occasion that made me design this power reverse, it was more for experiment purposes. It was about two years ago that I put this gear on. I have had it on ever since. When I designed that I thought probably we could switch a little faster with it. I find that on that class of engine I can reverse it by hand just as quick as I can with the power reverse. This power reverse is air operated, there is an eight-inch cylinder with a cup on each side, and a four-way valve. A small lever in the cab operates this four-way valve. All the lever does is to operate the valve, change the position of your links. The hand reverse takes the most strength, but you can reverse the engine quicker by hand than you can with the power reverse. I should guess that the weight of the engine is about 112,000 pounds on drivers.

I have not had occasions on our road when it takes considerable strength to throw over the Johnson bar, unless you stop with
1168 your cylinder full of steam. Of course, you can open the cylinder cock and relieve that pressure and then reverse. As to whether I brace myself when I am throwing over the lever with the cylinders full of steam, I never try to reverse; I always relieve the pressure in the cylinders before I try to reverse. That is on account of the steam in the cylinders. Lots of times when you stop to release the brakes or something of that kind, some of your cylinders are full, and you want to go the opposite way, you have the boiler pressure in your cylinders. You can't handle the engine with the steam in there, it would be injurious to the engine if you did handle it.

I used to break in engines on the Illinois Central out of Memphis. I still have to break in the engines on my present road when they have been overhauled. I break them in myself. The levers are always stiff after the engine comes out of the shop. I do not have a black fireman to throw over the lever for me and assist me; I am able to throw it over, myself, but it is hard. With all the parts put up snug, the engine is naturally going to handle hard. As to whether I have had that same experience with the power reverse gear, I have never overhauled it since I put the power reverse gear on the engine. But that power reverse gear mechanism would take over the gear without difficulty.

The engines when we bought them had the foot braces on them. We bought the engines from the Southern, and they came equipped that way and I never took them off. I suppose the foot brace is to help the engineer out in reversing when the engine is overhauled. They don't actually need it if the engine is broke in, but they would need it if the engine just came out of the shop. As to why we don't take it out if that is the only reason for having it, probably we will overhaul the engine sometimes and we may need it. They
1169 would be useful at any time when the engine was handling a little hard. The purpose of it is to give a better purchase for the pull, if something should happen you would have the brace. As to whether conditions might arise where the use of that brace would be necessary in order to get it over, it could not unless the engine had been overhauled or the engine stopped with steam in the cylinders, which can be relieved by opening the cylinder cocks. As to whether any other condition which would make the lever work harder than usual would be another condition where the brace would be necessary, there is nothing that will make it work hard except steam in the cylinders or after the engine has been overhauled. If you had dry valves and were not getting the lubrication on the slide valves that would have that effect, but if you reversed it it would be injurious to the engine, you would cut the valves. You should not allow the engine to run dry. You can tell by the action of your engine when they are in that shape. Anybody that has had any experience can tell a dry engine in a few minutes. I would not try to use the reverse lever with dry valves. I would put oil through the relief valve before the engine needs it.

REDIRECT EXAMINATION

We generally make one trip, 42 miles, with our engines after they are overhauled and before they are put back in road-haul service. We handle a light train with them to break them in. If the engine is put up properly you won't have any trouble working the reverse lever after the first trip.

(Witness excused.)

C. B. PATTERSON, age 56, employed by the Georgia & Northern Railway, Georgia, Ashburn, Sylvester & Camilla, and the Flint River and Northeastern railroads as master mechanic and road foreman of engines, testified:

1170 DIRECT EXAMINATION

I have been working at railroad experience since I was about 18 years of age. I started with the Central of Georgia, I worked for the Southern Railway and for the Mobile & Ohio and the Seaboard Air Line. I have been with the Georgia & Northern 31 years. We have mixed service at the present time. That road runs from Boston

to Albany, 38 miles. It is kind of rolling country. I think the maximum grade is 1 percent. We have three 10-wheelers, and we have two Pacific types and one Mikado locomotive on the Georgia & Northern. Those engines are reversed with a power reverse gear on five of them and the other engine is reversed by hand reverse gear. The engine equipped with hand reverse gear has a plain slide valve or Stephenson motion. That engine is not superheated. The other five engines are not superheated; there are only four of them that are superheated (tes., pp. 4083–4093).

The engineer on the Georgia & Northern will average about 2 hours a day in switching. We have one crew on that road. They work about 11 hours a day, seven days a week. Our work is performed in the daytime. Our train is a scheduled train. Our engineer has to report for duty just a few minutes before leaving time, just enough to oil his engine up and get his orders and leave.

The reverse lever in the cab of that engine is on the left side, a convenient distance to handle, to the left and in front of the engineer. I should say there are five or six inches clearance around the reverse lever and with relation to the engineer's seat box on the locomotive which is hand reversed. I have run that engine as an engineer. In running it as an engineer, I did not have any difficulty in reaching the appliances on the boiler head when the reverse lever was in the extreme back motion. The reverse lever did not interfere with my reaching the brake valve in any way. I operated my reverse lever from the seat box. Our engineer operates it the
1171 same way. I should not think it would take any unnecessary strength or effort to move or handle the hand-reverse lever either in reversing the engine or hooking it up or dropping her down. I didn't find any trouble at all, no effort, with it. I sometimes use two hands and sometimes one hand when I reverse my engine. I never have to have assistance in doing that. I do it while I am sitting down on the engineer's seat box. That engine has not got a foot brace on it. The engineers have never made a request for a foot brace on it. We have no block signals on the Georgia & Northern to be observed.

About two hours switching has to be done on the Georgia & Northern. That is about evenly divided between forward and back-up movements. I operated the engine as an engineer while it was used in switching. As to the position I took in the cab in that back-up switching movement when operating the engine, I sat crossways of the seat with the lever in front of me, so I could observe both directions. I got my signals from the men on the ground. I did not have any difficulty in getting those signals while I was operating the reverse lever. I don't remember whether I ever had the signals changed on me while I was operating the reverse lever; I don't think so. I have never had any accidents due to my failure to get the signals. Our engineers have never had any accidents due to their failure to get the signals from the men on the ground. I never

knew of any accidents our engineer ever had due to his failure to keep a proper look-out for crossings.

Our engineer has never reported to me that the reverse lever on this hand reverse engine ever jumped out of the quadrant. He has never made any report of it having gotten away from him at any time. Our engineer has never made any report to me about the reverse lever threshing to and fro in the quadrant. I have never had any difficulty in clearing the cylinders of steam on that engine. Since I have been connected with the Georgia & Northern, none of our engineers have been injured while operating the manu-
1172 ally operated reverse gear or the power reverse gear. The engineer on the manually reversed engine has never asked to be relieved from duty on account of having to operate that manual reverse lever. He has never complained to me about not having enough time to perform his duties while reversing that engine with the hand reverse lever. I did not find any difficulty in performing the duties of an engineer when I was operating the engine with the hand reverse lever. It was not excessively heavy for me to operate.

Two of these five engines that are equipped with power reverse came to the road equipped that way and we equipped the other three. This manually operated engine is used mostly as an extra engine, it is the smallest engine we have, it is kind of a relief engine. It is not on a regular run.

One engine on the Georgia, Ashburn, Sylvester & Camilla is a power reverse and the other is a hand reverse. The 2–8–2 is equipped with power reverse. That engine is used in mixed service. The manually operated reverse gear engine is merely an extra engine, just a relief engine. I have operated that hand reverse engine on the Georgia, Ashburn, Sylvester & Camilla. My experience with reference to that engine is the same as I have testified to as to the engine on the Georgia & Northern.

Both engines on the Flint River and Northeastern have hand power reverse gear. I have operated those engines. My experience with reference to those engines is very similar to that with the other hand reversed engines that I have testified about. None of the engineers on any of these roads has complained about having to use the hand reverse lever on those engines. They have never asked us to equip these engines with power reverse gear.

CROSS-EXAMINATION

I may run the manually reversed engine on the Georgia & Northern Railroad once or twice a month, something like that.
1173 I sometimes take the engine when I am riding with the engineer, to see how the engine is performing. I run it for a trip or half a trip.

"Q. That would be just a few miles?

"A. Well, maybe for a trip or half a trip."

I have handled the engine during an entire round trip where I did all the switching. In fact, recently I have helped to make several trips.

(Witness excused.)

R. K. PERSONS, age 41, superintendent and general manager of the Talbottom Railroad, testified:

DIRECT EXAMINATION

As to how many years railroad experience I have had, I have been superintendent since 1916; that would be about 15 years. As superintendent I have charge of the engine crews. The Talbottom Railroad furnishes mixed service. That railroad is located in Talbot County, Ga. It is about seven miles long and has one locomotive. It is a two driver Rogers locomotive, two drivers to the side, hand reverse gear, slide valve motion. I can't tell you whether it is the Stephenson link. That engine does switching service; I suppose 30 minutes in the course of a day would cover it. As to how many hours a day that engine is in service altogether, it is supposed to leave out at 12:15 and get back at 2 o'clock. It is only running, though, about 30 minutes. It lays over at Junction City to make connection with the Central of Georgia, and then comes right back. It runs six days a week.

The reverse lever in the cab of that engine is right on the left hand side of the engineer's seat. He has a box seat, and it is to his left about six inches out from the seat I suppose. The engineer's seat box is stationary, lifts up so you can keep things in the
1174 box. There must be six inches clearance around the reverse lever and with relation to the engineer's seat box. I have never run that engine as an engineer. As to whether I ever observed the engineer running it, I ride the engine very often. The engineer does not have any difficulty in reaching the instruments on the boiler head. The reverse lever does not interfere with his reaching the brake lever. The engineer operates that reverse lever while sitting on the seat box in switching service (tes., pp. 4093–4103).

The engineer has never complained to me about the hand reverse lever requiring more strength to operate than he could muster. He has never called upon me to furnish any assistance for him at any time. There is no foot brace on that engine. The engineer has never asked for one. We have no block signals on the line. The engineer has never been injured by the use of the reverse lever on that engine. He has not had any accidents due to his failure to get the signals from the men on the ground in switching service. He has never reported to me any difficulty with reference to the reverse lever jumping out of the quadrant, or that the reverse lever has gotten away from him at any time. He has never complained to me in any way about the reverse gear on that engine. He has not asked us to put a power reverse gear on that locomotive.

CROSS-EXAMINATION

I can't say about all Rogers engines, but this Rogers engine is not hard to reverse. I am not an engineer. Any work that the engineer may want done on the reverse gear he would have to report to me.

(Witness excused.)

R. L. HICKS, age 44, employed by the Tennessee & North Carolina Railroad as locomotive engineer, Newport division, testified:

1175 DIRECT EXAMINATION

I have been running as an engineer on the Tennessee & North Carolina Railroad since September 23, 1916. I have had experience as an engineer in mixed trains. I now run between Newport, Tenn., and Crestmont, N.C. Those points are the respective terminal points on that division. We have one locomotive on that division, a 4–4–0, 8-wheeler Baldwin, hand reverse, Stephenson link motion, balanced slide valves. I haul from one to three cars at the present time with that engine. We have hauled more than that, up to 20 or 23, somewhere along there. Some days we have 10 to 15 minutes switching on the road, and some days we don't have any at all. That engine is operated two days a week at the present time, Tuesdays and Fridays. I go on duty at about 6:30 and get off about 12 o'clock to 12:30.

We have a regular stationary seat box with a curtain on that engine, use it for a tool box and seat box combined. The reverse lever is located forward and to the left with reference to the seat box. We have what I would think plenty of clearance around the reverse lever and with relation to the engineer's seat box, about six inches. That reverse lever does not interfere with my getting to the instruments on the boiler head at the engine, or reaching the brake valve at any time. When I am operating that reverse lever, I sit in the engineer's seat box all the time, even in switching. I have no difficulty in operating it while sitting in my seat box. About 50 percent of my switching is a back-up movement. I sit on the seat box while I am in that service, just merely turn around. We have no foot brace on that engine. I don't see any use for one. The reverse lever has never gotten away from me, to my recollection, while I was hooking up the engine or dropping it down. The reverse lever has never threshed backward and forward in the quadrant while I was operating it.

I have never been injured by the reverse lever. I have never been prevented, to my knowing, from getting the signals from
1176 the men on the ground when I was switching because I had to operate the reverse lever. I have never had any accident due to my failure to get any such signals, or to my failure to get any signals, or to my failure to observe road crossings. I have time

enough to perform my other duties and still operate the hand reverse lever. The manually operated reverse gear is not hard for me to operate. It does not require any excessive amount of strength from me. I have never had any of these reverse levers break with me. I have never been required to place myself in a hazardous position, to my recollection, in order to operate the manual reverse gear.

(Short Lines' exhibit no. 41, a statement entitled "Synopsis and Summaries of Answers of 232 Short Line Railroads to Questionnaire Relating to Operating and Financial Conditions", was received in evidence, subject to complainants' objection to the compilations included in the exhibit.)

CROSS-EXAMINATION

If you allow your valves or your cylinders to get dry it would be more trouble to operate the manual lever. When you have stopped to make a coupling or something of that kind and your dry pipes are full of steam, it would make it harder to reverse. If you get to foaming, or get too much water, naturally it washes the lubrication off of the valves and would make it work hard. Under those circumstances I always speed up my lubricator going into the valves. As to whether I attempt to handle the lever while I have dry valves, I never had a valve dry enough but what I could reverse it and handle the engine right along. Of course, when the excessive lubrication got to the valve, it would be more easy to come back and handle again.

I have never had the experience of breaking a strip, having it catch in the ports. As to whether I ever ran an engine with
1177 the strips spoilt, I have run an engine until the strip was worn and it was necessary to renew it, and I would renew them. The reverse gear does not work harder with that condition; that lessens the pressure against the plates, and if you keep it lubricated it is not as hard as when you get the new strips in. It would take more strength, but it would not be hard to reverse. I don't remember ever having the counterbalance springs get out of adjustment (tes., pp. 4103–4113).

(Witness excused.)

H. S. MANTOOTH, general superintendent of the Tennessee & North Carolina Railroad Company, testified:

DIRECT EXAMINATION

The Tennessee & North Carolina Railroad consists of three divisions. There is no physical connection between those divisions. They are the Newport division, the Knoxville division, and the Andrews division. Mixed-train service is rendered on the Knoxville division, freight-train service on the Andrews division. The Andrews division extends from Andrews, N.C., to Hayesville, N.C., 25

miles. The Knoxville division extends from Knoxville, Tenn., to Sevierville. We have two engines on the Knoxville division, manually operated reverse lever. We have the same kind of reverse gear on the Andrews division. The operating conditions testified to by Mr. Hicks with reference to the Newport division are substantially similar to those on the Knoxville and Andrews divisions.

Our engineers on either of those divisions have never asked us to equip those engines with power reverse gear. They have never complained to me at any time about the manual reverse gear. We have never had any of those engineers injured in the operation of the manual reverse gear. We have never had any accident on those divisions that I know of due to the failure of the engineer
1178 to keep a proper lookout of crossings and so on. I have never been called upon to relieve an engineer from duty on account of exertion due to the operation of the manual reverse gear. I should judge our engineers on the Knoxville division are between 40 and 45 years old, and about 38 on the Andrews division. Mr. Cole, on the Knoxville division, will weigh something near 175 pounds and Mr. Wilson will probably weigh 190. As to whether I have observed those engineers in the performance of their duties, I have never paid any particular attention to it. I have been on the engines, but I don't ride them often.

CROSS-EXAMINATION

We have no organization of engineers and firemen on our road. When one of our engineers wants some work done on an engine, he does not go to me about it. I leave that up to the mechanic, to keep the work up. They make out daily reports and file them in the office at the shops. I don't follow the detail of that work.

(Witness excused.)

C. L. LARMEE, employed by the Kentucky & Tennessee Railway as master mechanic, testified:

DIRECT EXAMINATION

I have been master mechanic for the Kentucky & Tennessee Railway since 1909. I have been with the road 28 years altogether. Prior to becoming master mechanic, I was machinist. That road runs from Stearns, Ky., to Bell Farm, Ky., 21 miles. The territory through which it runs is hilly and mountainous country. The road renders freight service mostly in the handling of coal and timber products. We have six locomotives, three engines equipped with power reverse and three with hand reverse. The three Mikados are equipped with power reverse gear. Those that are equipped with hand reverse gear have the Stephenson link motion, slide valves.

1179 As to how many hours a day our engineers are on duty, the train and mixed service is on duty 12 hours, and those in freight service on an average of about 8 hours. I would say about 20 percent of that time is devoted to switching in each type. We operate six days a week. We have a passenger train on Sunday, we don't operate any freight on Sunday. On the weekdays we hook a passenger coach to our freight train and run that as a mixed train. We have three coaches and we handle baggage and express and a freight car or two.

The reverse levers on the hand reverse engines are located on the left and forward with reference to the engineer's seat box. We have some stationary seat boxes and some with a drop seat on those engines. There is plenty of clearance, six or eight inches, around the seat box and with relation to the engineer's seat box. The reverse lever does not interfere with our engineer getting to the appliances on the boiler head, or with his reaching the brake valve. Sometimes our engineers operate the reverse lever from the seat box; in switching they usually stand up. They have never complained to me as to the strength required to reverse the engine or hook it up or let it down when operating a hand reverse engine. The only time they need another man to assist in the operating of this hand reverse lever is when they break in an engine after it is overhauled. Sometimes they are a little tight, new pins, and everything is taken up, and in breaking in an engine sometimes they will get a steam trap in the cylinder. We usually run an engine around in the yard a day after it has been repaired before putting it in road-haul service. As to whether we give the engineer some assistance in operating the reverse lever during that time, we don't have a regular engineer to do that, the shop forces usually break in the engine. Sometimes the fellow who is operating the engine just has to throw the reverse lever, but not as a rule.

1180 "Q. If he needs it, do you furnish it to him?

"A. Well, he has the fellow who is riding with him. That only happens once in a while."

We do not have foot braces on those engines that are operated by manual reverse gear. Our engineers have never requested us to equip those engines with foot braces. Our engineers do about the same amount of switching with the hand reverse lever as those with power reverse. I have observed them in the performance of their duties in switching with those engines. When they are switching in a back-up switching movement they usually stand up. Sometimes they sit on the window sill and sometimes they just stand; they usually stand up in switching. They have never complained of having difficulty in getting signals from the men on the ground when they are using the hand reverse lever in back-up switching movement. Our engineers have not had any accidents [due] to their failure to get signals from the men on the ground since I have been master mechanic of that road.

We have had no complaints from our engineers as to the manually operated reverse lever jumping out of the quadrant, or getting away from them. We have had no complaints with reference to the reverse levers going back and forward all the way across the quadrant. We have no trouble in our territory with foaming water. Leaky dry pipes sometimes occur on these manually operated reverse gear engines. In my experience we have had about two leaky dry pipes to my knowledge. As to the effect that has on the operation of the manually operated reverse lever, it would destroy the lubrication of the valves. As to whether that is a matter that can be easily remedied, you have to repair the dry pipe to stop the leak. We have had no engineers injured by the operation of the manually operated reverse gears or the power reverse gears. We have not had to relieve any of our engineers from duty on account of exertion
1181 due to the operation of the manual reverse lever. The engineers operating manual reverse gears have not requested us to equip those engines with power reverse gears. They have made no complaints to me of any kind with reference to the manually operated reverse gear as to its operation, that is, outside of just the natural reporting of their work, to inspect the engines. It is liable that something has to be done to the reverse gear the same as any other part of the engine. The engineer may find that he has too much slack in his latch, or something of that kind (tes., pp. 4113-4123).

CROSS-EXAMINATION

There might be different things we get on the work reports that are made out with reference to the manually operated reverse gear besides too much slack in the latch; the reverse lever may not be properly balanced; the counterspring may need adjustment, so that the movement of the reverse lever will be with the same ease in this direction. There might be a slack or lost motion in the transmission bar, the reach rod. They have never reported the notches on the quadrant worn to my knowledge. They have reported the latch bad. That does not necessarily include the wearing of the notches. The notch wears faster than the quadrant, from the fact that you are engaging the same teeth on the latch over the whole sector of the quadrant in different places. That is, the wear on the latch would be more perceptible than the teeth on the quadrant. It is like running a little gear on a large gear. The little gear comes in contact with the large one oftener, and there is more wear. Sometimes the spring on the latch handle gets too weak and has to be removed. We have never had any report of the reverse gear working hard. It would probably need a counterbalance; it may work hard in one way, in backing up, and it may be that the reverse gear is out of balance.

The engineers and the firemen have a grievance committee on our road; they bring up matters of grievance. Neither of
1182 those committees makes any request on us to equip these

large Mikado type engines with power reverse. We bought two engines with the power reverse. The first power reverse we had before we got the large engine we installed that ourselves, 15 years ago. That is on a small Mikado. As to whether we have found that the power reverse we have is satisfactory and suitable in service, we have no trouble with it. I would say that we run about 10 miles an hour over there. About 15 miles is the maximum ordinarily.

(Witness excused.)

W. J. LIPSCOMB, of Autaugaville, Ala., agent and superintendent of the Alabama Central Railway, testified:

DIRECT EXAMINATION

I have been on the Alabama Central ten years; all that time as agent and superintendent. We have one locomotive on that line. The line runs from Autaugaville, Ala., to Booth, 8½ or 9 miles. We haul freight. That engine is reversed with a hand reverse, slide valve motion. I do not know the name of it. I have run that engine as an engineer nearly as much as the engineer. We haul one car at a time when we can get it. We have a little bit of switching, 15 or 20 minutes a day, picking up the car. We operate six days a week, between 8:30 and 10:30 a.m.

The hand reverse lever on that engine is about 14 inches to the left of the engineer's seat box. We have a hinged seat box on that engine, it would not slide backward or forward, you drop it down or lift it up. There is plenty of clearance, 14 to 20 inches, around the reverse lever and with relation to the engineer's seat box. When I was operating that locomotive, I did not have any difficulty with the reverse lever getting away from me. I have had no difficulty with its threshing backward and forward on the quadrant.

1183 I have never been injured by the hand reverse lever. Our engineer has never been injured by the reverse lever. It does not take very much strength to operate the hand reverse lever on that engine; a man can operate it easily. I weigh about 148. I do not have any difficulty in operating that hand reverse lever. Our engineer weighs 165 or 170. He has never complained to me about having any difficulty in operating that reverse lever.

(Witness excused.)

W. C. WHITE, of Cadiz, Ky., general manager of the Cadiz Railroad, testified:

DIRECT EXAMINATION

I have been general manager of the Cadiz Railroad five years. I have been with that railroad five years. I have had no other railroad experience; I was raised up on the Cadiz Railroad. That railroad is in West Kentucky. It runs between Cadiz, Ky., and Gracey, Ky., ten miles. It is engaged in mixed service. We have two locomotives, the 4-4-0 type, hand reverse, slide-valve motion, Stephenson

link motion. We haul from one to four cars to a train. About 10 or 15 minutes a day at each end of the road are spent in switching on our road. We operate six days a week. It takes me three hours to complete my work for the day.

There is a stationary seat box on the engine and the reverse gear is to the left, directly on a lever [level] with it. I am not familiar with the clearances around the reverse lever and with relation to the engineer's seat box. There is about six inches clearance between the reverse lever and the seat box. Our engineer is 65 years of age. He has been on that run ever since the road started in 1901. He had not had any railroad experience prior to that time. He has never complained to me about not being able to get to the appliances on the boiler head. He has never complained to me about any interference from the reverse lever in getting to the brake valve on that
1184 engine. Since I have been with the road we have had no injuries to the engineer due to the operation of the manual reverse gear. He has never reported to me that the manual reverse lever got away from him while he was hooking up the engine. He has never made any complaint to me of any kind about the operation of the reverse lever. If there were anything wrong with the reverse lever, he would make his report to me.

As to whether I have observed the engineer in the operation of the engine, I have been on the engine with him in the yard, and I make about a trip a month over the road. He sits on the seat box when he operates the reverse lever. We do not have a foot brace on that engine. The engineer has never asked for one (tes., pp. 4123–4133).

(Witness excused.)

July [30], 1931

L. T. NICHOLS, superintendent of the Carolina Northwestern Railroad, testified:

DIRECT EXAMINATION

I have had about 56 years' railroad experience in various capacities, but not as an engineer or fireman in service. I have been on the Carolina Northwestern about 45 or 46 years. I have been superintendent of that line since 1893. The Carolina Northwestern runs between Chester, S.C., and Edgemont, S.C., 135.5 miles, including 9 and a fraction miles between Newton and Hickory, N.C., over the Southern Railway. The territory through which this road runs is a rolling country, mountainous on the upper end. On the north end, north of Lenoir we have about a 3.4 percent grade for a short distance. South of Lenoir, about 2.4 percent for a short stretch, and the other grades run around 2 percent and less.

1185 We have freight, mixed and passenger service on the Carolina Northwestern. We have 12 locomotives. One of them we are retiring now, and the other one will be retired this fall. Of the remaining 10 locomotives, eight are reversed with a manual-reverse

gear and two of them are equipped with Alco power-reverse gear. Some of these engines that are reversed by hand have the Walscheart valve motion and some of them have the slide valve, the Stephenson link motion. We average about 12 cars to a train on our road. The maximum number would vary considerably. For short distances we might have quite a good many, because our line is very varied in its service.

Our freight service, I would say, would take up about 60 percent of the time in switching. Our freight crews operate six days a week. As to how many hours a day the engineer of those crews is on duty, the freight crews would be about 8 hours on the average.

I am not familiar with the location of the manual-reverse levers in the cabs of our hand reversed engines in detail, but in a general way I am. The reverse levers are just to the front of the engineer's body in the correct position, and to the left when seated on his box. We have six locomotives with a drop seat and the others are seats with a box. I have observed the engineers very frequently in the performance of their duties on those locomotives. I have never observed the engineers have any difficulty in getting to the appliances on the boiler head of the engines. They have never made any complaint to me about any difficulty of that nature. They have no difficulty in getting to the brake valve on the engine.

The engineer generally suits his own comfort in operating the manual-reverse lever. One man will very frequently work from the floor standing, and another one will sit on his box, and another one will throw himself out of the window to look both ways.
1186 It depends a good deal on how much switching he has to do, and what the particular movement is. I have observed our locomotive engineers while seated on the seat box operating the manual-reverse levers. As to whether our engineers have complained to us at any time with reference to the amount of strength required to operate the manual-reverse lever on those engines, the only complaint we have had was with reference to the two engines that we equipped; at their request we promptly equipped those engines, because the levers on those engines were very badly designed when they came from the builder. We remedied that and then we had no further complaints.

Some of our locomotives are equipped with foot braces. As to whether I have observed our engineers using those foot braces when they are reversing the engine, that would depend somewhat on the size of the man and his length. We have some rather tall men and some rather short ones, and some of them weigh from around 120 to 220 pounds, and those foot braces are there for them to use if they want to. Some of them use them and some don't use them. It is my observation that occasionally they use them.

There are quite a number of crossings on our road, but very few highways. It crosses only three or four of those State roads. We have had no accidents on our road due to the failure of the engineer to keep a proper lookout for those highway or street or road cross-

ings. We have had no accidents on our road due to the failure of the engineer to get the signals from the man on the ground when in switching service, because he would not move unless he got the signal. I have not had any complaints or reports from our engineers with reference to the reverse lever jumping out of the quadrant.

We administered discipline to this engineer where they struck the team on the crossing because he did not require that fireman to get up there and look out on his own side, but let him fire
1187 instead of doing that. He should have called the fireman's attention to his duty. As to whether it was impossible for the engineer to see the approach of that team, the engineer stood up on his seat box and looked over the tender, and he looked until they hit the team, and he didn't see it until then.

I have had no reports or any complaints from our engineers about the reverse lever getting away from them in hooking up or letting down the engines. Other than in the case of the two engines that we equipped with the power reverse gear, we have had no complaints from our engineers with respect to the reverse gears on our engines, and when we put those on they told us that those were the only engines to which it was necessary to apply them. By "they" I mean the engineers. They said they could handle the other engines all right, there was no difficulty in handling them. That is what they put up to us, and we promptly equipped those two engines to satisfy them. There was no further complaints. Several of the engineers called it to my attention that those engines were rather hard to handle on account of the peculiar arrangement of the reverse levers. The committee did not wait on us as a committee, but simply the different engineers would bring the question up to us, and when I [they] did I asked them, "do you want us to put them on these two for you, or do we have to put them on all of them", and they said, "no, the others are all right." Their complaint was that these two particular engines were hard for them to handle. I think three or four of the engineers complained to me about the gears on these two particular engines. I didn't go any further because that was enough. I went to the mechanical department then and investigated it and found it was true, and corrected it. We bought these two engines new from the Baldwins in 1912. The power reverse gears were put on in 1928 or 1929.

1188 The passenger engineer has a fairly regular engine, but the freight engineers take them as they get them. At the present time, a particular freight engineer would be operating the power reverse engine at one time and the hand reverse engine at some other time. Those engineers so far have not asked us to put power reverse gears on any of the other engines; we have had no complaints of the others.

I have no recollection of any of our engineers being injured by the operation of the manual reverse gear. We have never had to relieve an engineer from duty on account of exertion due to his operation of the manual reverse gear. They have never complained

to me about not having enough time to perform their duty as engineers and operate the manual reverse gear. I have no recollection of a reverse lever or Johnson bar breaking with the engineer. It has not come to my attention if the engineer has failed to observe signals by reason of his having to operate a manual reverse lever.

We have standard forms for the engineer to report defects in the working condition of the engine. He makes his report at the end of each trip. The report goes into the shop to the master mechanic. As to what the master mechanic does, assuming that the situation has been remedied, that report is marked as to each item by the man who worked on it whether he has completed the work and if he has failed to complete it, why. I don't know that I have any system of checking up on the master mechanic to see that defects reported by the engineers are remedied, except by going around to the shop and looking over them. We have had no complaints in recent years from engineers about defects on engines not being remedied by the forces of the master mechanic (tes., pp. 4134–4144).

CROSS-EXAMINATION

I do not follow through the work that is done on these engines, except as I may occasionally go through the shop and
1189 observe what is being done. I am not able to say what the experience of our engineers is as regards the number of occasions when they have to report any work to be done on manual reverse gears, but whenever they don't get satisfaction from the shop they come to me every time, and then I have to look into it. The reports as to a lever jumping out of the quadrant or getting away from the engineer or a manual lever breaking would be made to someone else if there is just a mechanical defect, but [if] there is any accident from it I would be notified by wire.

"Q. There may be minor injuries that a man would receive and not report at all, and you would not get any report?

"A. I don't think so."

My own experience with the performance of these levers is what I have observed on the trips when I have ridden the engines, in recent years. The engines which we have equipped with Alco power reverse gear are two engines of the 4–6–0 type, weighing 101,000 pounds on drivers. They seem to be very much pleased with the Alco gear.

(Witness excused.)

H. M. Anderson, of Anderson, S.C., age 47, employed by the Blue Ridge as engineer, testified:

DIRECT EXAMINATION

I was promoted to be an engineer on the 4th of March, 1903. I have not been running altogether ever since, I fired some. As to

how long I was a fireman, I went to work for the Blue Ridge in 1902 and was promoted in 1903. I have had experience as an engineer in all classes of service. The Blue Ridge runs between Belton and Walhalla, 44.1 miles. I am in passenger and mixed service. We have 10 wheel engines on that line. I think the weight of the locomotives I operate is 107,000 pounds on drivers. It is reversed by hand. We have one power reversed engine on the Blue Ridge. Its weight on drivers is something over 140,000 pounds, some-
1190 thing like 145,000. None of our engines is superheated. The average speed we make with our locomotives is about 25 miles. The maximum speed is 35 miles, sometimes a little faster. That is passenger. In freight service our speed is about 18 miles average and 25 miles maximum. Sometimes I switch probably 30 or 40 minutes a day, sometimes not that much and sometimes longer. I guess I am switching an hour some days. My run is a daylight run. I guess I spend about 5 hours all told on the engine.

The reverse lever is just to the left of the engineer's seat box on my engine. I operate the 10-wheel engine most of the time. That weighs 107,000 pounds on drivers. We have plenty of clearance around the reverse lever and with relation to the engineer's seat box. I weight 217 pounds. There is plenty of clearance for me. I do not have a bit of difficulty in the world in reaching the brake valve on the engine. The reverse lever, when in the extreme back motion, does not interfere with my reaching appliances on the boiler head. I operate the reverse lever from the seat box, even in switching service. I don't have to use any strength to move the reverse lever either in hooking up the engine or in dropping down, or in reversing; I use one hand mostly. I have never called anybody to help me reverse it.

I have a foot brace on my engine, and sometimes in riding on a run I use it to rest my foot, but I hardly ever use it to reverse the engine. When I do use the foot brace, I do not have a bit of difficulty in reversing. My practice in using the reverse lever as to whether I use a few notches at a time is according to the grade and the tonnage we have behind us. If I have a tonnage train and am on a grade, as I pick up speed I link up the engine a notch or two at a time. As to whether we have any block signals on our road, we have only one crossing, the Southern main line. We have a number of road and highway crossings. I do not have a bit of difficulty
1191 in the world in observing those crossings and operating my engine with the manually operated reverse lever. I have never had any accidents due to my failure to observe those crossings.

Just about as much of the switching that I do is done in a back-up switch movement as forward. When I am in a back-up switch movement, I just look back like that [indicating], I don't move off the box. I do not have any difficulty in getting signals from the men on the ground when in that position. I have had no accidents due to my failure to get signals from the men on the ground. As to my practice in switching in taking signals from the men on the

ground and in reversing the engine, I don't move the engine until I get the signals. I make sure of my signals first. I have never had any difficulty in having the reverse lever jump out of the quadrant. The reverse lever has never gotten away from me while hooking up the engine or dropping her down. I have never had any experience with it threshing to and fro on the quadrant. I don't have any trouble at the present time with foaming water in my territory, but I have had in years gone by. I have never been injured by the operation of any hand reverse gear.

I have operated an engine equipped with power reverse gear one or two trips. I did not have a bit of difficulty with that. I was never injured by a power reverse gear.

I have never found the manual reverse lever difficult or hard for me to use at any time. I have never had a Johnson bar break with me. I have never been prevented from keeping an effective lookout by reason of having to operate a manual reverse lever. I have never been prevented from performing any of my duties as an engineer by reason of having to operate the manual reverse lever.

CROSS-EXAMINATION

I have had cylinders full of steam sometimes and just kicked the cylinder cocks open. I kicked them open because it makes it
1192 a little easier. If you let the steam remain in the cylinders, it is a little harder pull on the lever, not much, but you can tell the difference.

My counterbalance spring has gotten out of adjustment. It does make a little difference when it got out of adjustment. As to what are some of the occasions or reasons that make the lever handle harder than other times, sometimes a locomotive will stand around a shop a few days, and the valves will get dry, and that will make the lever hard. I very often sometimes dope through the relief valves before going out, when the engine has been standing for a few days. They may run them in the shop when the engine is cold, and the valves will get rough, the slide valves. Whenever you get dry valves it makes the lever operate harder. As to whether I have ever had the experience of breaking a strip and having it catch in the port, I have had valve yokes to break. As to what is the immediate effect on me or the lever if I am handling it when a yoke breaks, I never had that happen. The lever stayed right where it was when the valve yoke broke. If I had the latch disconnected and had hold of it when that break occurred, I don't think there would be any effect on me, but I have never had that experience. I would not say there would not be (tes., pp. 4144–4155).

The throttle is on top of the boiler of the engine I operate and the air brake is on the left, a little bit higher. The gage cocks, and the throttle, and the engineer's brake valve are on the boiler head. As to whether I have to reach across the quadrant to get at those, I reach right out over the quadrant to get to the lubricator, and the throttle

and the brake valve is right behind. I can't tell you exactly how high the reverse lever is above the foot board. I don't think
1193 it would come quite as high as my shoulder, but pretty close to it. If the lever was to come all the way down the quadrant to the reverse motion when I had my arm out reaching any of those appliances that I told about, the lever would not come in contact with me. It would not bother me because it would not reach me. None of those appliances is below the level of the lever on this locomotive that I operate.

I meant by an effective lookout that the reverse lever does not interfere with my looking out. I don't think that it is necessary for an effective lookout that I keep my eye on the ground man all the time in switching. The ground man sometimes changes his signals. As to whether I might move my engine contrary to the changed signal if I don't keep my eye on them, I wait until I get the right signal before I move. As to how I know it is the right one unless I keep my eye on the ground man, I do keep my eye on him. If I am backing up I keep my eye on him until he signs me down. I don't say I keep my eye on this man all the time, I won't say that.

I said that when I am making back-up movements I simply sit on my seat box and look back. As to how I get ground signals when I am backing up, I just turn around and look back. Turn around sometimes and sometimes I just look over my left shoulder, backing up. When I turn around in that manner, if I look over my left shoulder, my back would be out the window and my head would likewise be out of the window. When I am in that position, if my lever was in the full forward motion and I wanted to throw it into full reverse, I could reach it and still keep my head out of the window. I imagine the top of the lever would move about 3½ feet in going from one end of the quadrant to the other.

"Q. Is the center of the quadrant about even with the center of your seat box, or is it forward?

"A. The center of the quadrant, I don't say whether it is the center or not, I never paid any attention to it, I never had any trouble about reaching it."

1194 I will reach it with either hand, right or left. When I am sitting with my back to the cab window and my head out of the window, looking backwards, if my lever was in full forward motion I could not reach it with my left hand; I would reach it with my right hand then, and when I go forward I throw it over to my left hand. I do that lots of times. I don't keep my head out of the window all the time. As to what I do, I have other things to do. When I am switching I watch the signals. I don't keep my eye on the ground man all the time. If I am sitting with my body forward and I turn around and look over my right shoulder to the rear and my lever is in full reverse motion and I want to pull it to go ahead, I could continue to sit in that position and watch

the ground man and reach behind me and reach the lever. I do that; I do all kinds of ways.

(Witness excused.)

J. W. FLETCHER, superintendent of the Blue Ridge Railroad, called as a witness for the High Point, Randleman, Ashboro & Southern Railroad, testified:

DIRECT EXAMINATION

I have had some official connection with the High Point, Randleman, Asheboro & Southern Railway. I was superintendent of that road for 10 years, from 1920 to 1930. I have had about 43 years of railroad experience. The High Point, Randleman, Asheboro & Southern renders mixed service. That road extends from High Point to Asheboro, N.C., 27.8 miles. The country through which that road runs is hilly. They have two locomotives. Those locomotives are reversed by hand, Stephenson valve motion, slide valves. The engineer on that road works eight hours a day. Four hours of that time is spent in switching. They work six days a week.

1195 I know the location of the reverse lever in the cabs of those engines. The center of the quadrant is a little in front and to the left of the engineer's seat box. To the best of my recollection the clearance around the reverse lever and with relation to the engineer's seat box on those engines is between five and six inches. My recollection is that one of those seat boxes is stationary and one of them is a drop. When I was on that road I did not have any complaints from engineers as to their not being able to reach the instruments on the boiler head by reason of interference from the Johnson bar. I have observed the engineers operating their engines on that road. As to whether they can reach the brake valve on those engines by sitting on the seat box and without any interference from the reverse lever, I never saw them have any interference from it, even in riding the engine. Generally speaking, the engineers on that road operate the reverse lever by sitting down, except in switching. Generally in switching service they stand up with their back to the window and out of the window so as to be able to get the signals better each way. The yard at Asheboro is very crooked. When in that position they can keep their eye on the man on the ground and at the same time operate the reverse lever. I would not say as to whether these engines are equipped with foot braces. My impression is that they will, but I would not exactly say one way or the other (tes., pp. 4155–4165).

There are no block signals on that line to be observed by the engineer. There are three state highways and a number of country roads and farm road crossings on that line. While I was on that road there were no accidents due to the failure of the engineer to keep a proper lookout for the man on the ground when in switching service. We did not have any accidents on that road at any time

while I was superintendent due to the operation of the reverse lever.

1196 We did not have any engineers injured by it. I did not have any complaints from the engineers with reference to the reverse lever threshing backward and forward in the quadrant. I did not have any complaint about its getting away from them at any time. The engineers on that road never requested me while I was superintendent to install power reverse gears on any of those locomotives.

CROSS-EXAMINATION

The engineers would make complaints about the gears jumping out of the quadrant or any of the ordinary defects to me. As to whether they would make reports of worn parts on the gear and so on to the shop forces, the operation of the High Point road is rather peculiar. Those engines come out of the shop at Pomono on Monday morning, and go down to High Point, and they stay there for four weeks before they go back to the shop, unless there is some mechanical defect that they can't repair. They use one engine a month, and then the other engine a month without going to the shop. The consequence is that all reports of defects came to my office by telegraph, because they were not allowed to move those engines back to Pomono except on instructions from me. I have never gotten any reports of defects in the manual reverse gear. As to whether I mean that they have always been in perfect shape, I mean they were always in shape so there was no trouble with them while out in service. I have never given them any repairs during the time they were out from the shop. I assume they were repaired from time to time, the latches would be repaired and built up when they went into the shop, but it was never necessary to do that while they were out from the shop.

DIRECT EXAMINATION

I have some familiarity with the Yadkin Railroad. I was superintendent of it from 1920 to 1930. That railroad runs from Salisbury, to Norwood, 41 miles, with a branch from Hall's Ferry Junction to Baden, 11½ miles. My answer to those questions you have asked me with reference to the High Point, Randleman,

1197 Asheboro & Southern would be the same if you asked them with reference to the Yadkin Railroad, with the exception of one engine. There was one engine on the Yadkin that is equipped with power reverse. We never had any accidents to engineers with that engine. That engine was equipped with power reverse during my time. The Yadkin Railroad leases their engines from the Southern Railway. They make all general repairs on the engine. This engine went in for general repairs, and when it came out from the shop it had the power reverse gear on it. I do not know from my own knowledge why it was put on.

There are interchanges of rights among the engine crews on the Yadkin Railroad and on the High Point, Randleman, Asheboro &

Southern with the Southern Railway. On the High Point Railroad the Danville division men of the Southern Railway hold equal rights with the High Point trainmen and enginemen. The High Point enginemen hold equal rights on the Danville Railroad. On the Yadkin Railroad the Charlotte division men hold equal rights, and the Yadkin men hold rights on the Charlotte division. Their rights are interchangeable. The one seniority list includes the Yadkin Railroad and the Charlotte division of the Southern Railway. As to whether an engineer operating a manual reversed engine on the Yadkin or the High Point could bid in a run on the Southern Railway engine which was equipped with power reverse, his age gives him the right. There were men that had the age that gave them that right. They did not do it.

(Witness excused.)

B. J. TARBUTTON, Sandersville, Ga., general manager of the Sandersville Railroad Company, testified:

DIRECT EXAMINATION

I have had 16 years of railroad experience. The Sandersville Railroad operates from Tennille, Ga., to Sandersville, Ga., 4.26 miles.

1198 We have two engines. The total weight on drivers is 55 tons on one, and 60 tons on the other. They are hand reversed. I think they have Stephenson valve motion, slide valves. That engine is on duty, you might say, nine hours a day. He works about four to five hours a day, six days per week, and on Sundays he is on two hours. We have a regular locomotive cab box on our engines. I can't say whether the engineer's seat box is a stationary box or the kind that is fastened on hinges and drops down. I imagine it is stationary. The lid opens up and he keeps tools in there, but I think the box itself is stationary. As to the clearances between the release lever and the engineer's seat box, there is ample room to rest his feet up on this support. Our engineer will weight about 200 pounds. He has never complained to me about not having enough clearance; he has got all the clearance he needs. He has never complained to me about not having sufficient access to the instruments on the boiler head, and their being interfered with by the reverse lever; they are all within easy reach.

That engine has a foot brace. Sometimes the engineer uses it and sometimes he does not. There are no block signals or any other kind of signals to observe except in switching service; we have no signals on our line at all. We have two highway crossings outside of the two towns. All our crossings in town are not flagged, there are two that we don't flag; we flag the others. We have never had an accident due to the failure of the engineer to keep a proper lookout for crossings.

We have switching to do on that line, switching practically is our main work. I have observed our engineer performing his duties in

switching service. As to whether he stands up or sits down when performing that service, some of the mills he switches he has to stand some, the tracks are crooked. We have had no accidents on that road due to the failure of the engineer to get the signals from
1199 the man on the ground in switching service. No engineer has ever complained to me about not receiving these signals by reason of having to operate the reverse lever; we use two flagmen on the ground and he never has any difficulty. When the engineer has any complaint to make about his engine or the operating conditions he makes that complaint to me. We maintain a shop there and we work on those engines at intervals and he has never made a complaint about the manually operated reverse lever getting out of order. I know of no instances where the reverse lever has ever gotten away from the engineer. He has never complained of that. It has never gotten away from the engineer, we never had anything of that kind (tes., pp. 4165–4174).

CROSS-EXAMINATION

I said I would know of accidents to the reverse lever; if he had had a difficulty of that kind it would have been called to my attention. If a lever jumped out of the quadrant he would tell me about that because he would probably want it shopped, and they always take it up with me before they make the repairs. As to whether they take up with me various things to be done about the gears, the reports are handled with me and we go over the rest of it before we make any repairs at all. As to the kinds of repairs we make with the manual reverse, he has had some work to do on the entire locomotive from time to time but I don't recall any particular work on that lever. The engineer has never asked me to do anything by way of work on the reverse gear. As to whether I mean that from the time I have been there they have never made any repairs to it, he has done small work in the shop but it has never jumped out so anyone was injured or where there was any complaint. He has never reported to me or to the shop "lever working hard", "loosened up bearings", or anything of that kind. As to whether he ever reported valves running dry, he probably would not mention that to me, but in cases of material wear he takes it up with me before we do any overhauling of those engines. Dry valves would hardly be a great expense,
1200 he would not mention that. We have a master mechanic in the shop. I would get the ordinary reports that are made out to make adjustments on the counterbalance spring or to repair the latch or the quadrant; repairs on the quadrant which would be considerable expense, but what we call extremely minor repairs, when he gets the engine in there and takes it down, he does a good deal of that without getting authority, because it does not amount to any great cost.

(Witness excused.)

W. J. O'PRY, Danville, Va., superintendent of the Danville & Western Railway, testified:

DIRECT EXAMINATION

I have been superintendent of the Danville & Western Railway six years. I have had 15 years railroad experience altogether. About 14 years of my time has been spent on the Danville & Western and the other year was spent on the Southern Railway. We have freight and passenger mixed service on the Danville & Western. That road is 81 miles long and operates between Danville, Va., and Leaksville, N.C., and between Danville and Stuart, Va. We have seven locomotives on that road, all hand reversed. We have one Walscheart valve motion and the rest are Stephenson. They are slide valves.

In passenger service we haul two cars in a train, and freight and mixed from 10 to 12 cars. Our passenger trains make about 21 miles per hour and our freight trains 15 miles. We operate our freight trains six days a week and our passenger trains seven days a week. Our engineers are on duty from 10 to 12 hours per day. All our work is in daylight. We have no scheduled freight trains. On all runs the engineer reports 30 minutes before leaving time. He prepares his engine between the time he reports and the time he leaves.

I am familiar with the location of the reverse gear in the
1201 cabs of our engine. The quadrant is about eight inches from the front of the seat box, and is immediately in front of the box, and there is about 24 inches clearance between the quadrant and the outside of the cab. There are no points around the engineer's seat box where the clearance with the reverse lever is close. None of our engineers has complained to me at any time of having difficulty because of the clearance of the reverse lever with reference to the seat box. They have not complained to me at any time of having difficulty in getting to the appliances on the boiler head; the Interstate Commerce Commission inspector keeps us pretty well instructed about those things.

I have observed the operation of our locomotives by our engineers. Some of them operate the reverse lever*se* while sitting down and some of them don't. As to what time they stand up to operate the reverse lever as a rule, they stand up if they can due to the height of the tender, see over the tender to get a signal. In those cases I believe they stand up and look out the window. That is in switching service that they do that. They have never complained to me about not having enough strength to operate the manual reverse lever. We have never had to relieve an engineer from duty due to exhaustion from having operated the reverse lever. Our engines are equipped with foot braces. I think the engineers use them as a rule.

We have not had occasion to discipline an engineer at any time due to his failure to keep a proper lookout for signals or crossings.

We have had no accidents on our road due to the failure of the engineer to keep a lookout for signals or crossings.

We have not had any engineers on our road injured by the operation of manual reverse levers since I have been superintendent. The engineers have never complained to me or reported to me that the reverse levers have jumped out of the quadrant while they were hooking up the engine or dropping down the engine. So far as I know, the reverse lever has never gotten away from one of our
1202 engineers while operating it. The reverse levers have not threshed back and forth on the quadrant that I remember. None of our engineers has asked me to equip any of those locomotives with power reverse gear.

CROSS-EXAMINATION

We don't have a brotherhood committee on our road, we have a local chairman. The Federal inspectors have never required us to make any changes in our reverse gear or suggested repairs to it.

Our engineers make out work reports at the end of each run. I am familiar with those for the reason that our master mechanic always consults me every morning as to the repairs he expects to make, and the repairs he has made on engines, and as a rule we go over those reports. I don't see the reports personally, but he tells me that an engineer came in and certain things he did on a certain engine and that is how I happen to know about it. As to the nature of the repairs we make on a manual reverse gear, sometimes an engineer will come in and say that the bar is rattling, that is, in the quadrant, and to tighten it, or something of that kind. That is about the only complaint that I have ever heard of.

(Witness excused.)

T. H. DOYLE, Milstead, Ga., employed by the Milstead Railroad Company as engineer, testified:

DIRECT EXAMINATION

I have been running on the Milstead Railroad as engineer since 1918. That company owns 2.7 miles. We have freight service only on that road. We use Shay geared locomotives. They are operated with a hand reverse lever. We are supposed to work six days a week, but on Saturdays we don't make any trip at all. When I am running as an engineer I put in about five hours a day on the job at the present time. All my work is done in the daytime (Tes., pp. 4174–4184).

1203 I have a seat box on my engine. The reverse lever is about eight or ten inches to the left of the seat box, facing the seat box. I suppose the clearance between the reverse lever and the seat box is around eight or ten inches. I never measured it. I would say that it is ample for my operation of the engine. I have never had any

difficulty of any kind in operating that engine, or any accidents. I have no signals at any time to observe. I do not do any switching with that engine. I have never been injured while operating the engine.

(Witness excused.)

ALEX. WHITTAKER, Sylva, N.C., engineer on the Tuckaseegee & Southeastern Railroad, testified:

DIRECT EXAMINATION

The Tuckaseegee & Southeastern is located in Jackson County, N.C., and is 12 miles long. We have freight service only on that road. We have one locomotive, a Shay-geared engine, weighing 140,000 pounds on drivers. I am the only engineer that the road has. I have around an hour and a half switching service a day to perform with that engine. I work six days a week. I am on duty about eight hours a day. We report for work at six o'clock in the morning and get through at 2 or 2:30 in the afternoon. That engine is reversed by hand. The reverse lever is about four feet from the floor. I have never had to have any assistance in reversing the engine with that hand lever. I have never had any difficulty with that lever in any way. I have never had any accidents with that engine. I have never had to lay off work as an engineer on that road. In switching service I have never had any difficulty in getting signals from the men on the ground while I am operating the reverse lever on the engine.

We have a square seat box about 12 inches square on that engine.

I sit down when I am operating that engine. I sit on the
1204 seat box part of the time when I am switching. If you are doing your work ahead of the engine you sit on the seat box, and when you are backing up you get up and stand in the window. I have never had any difficulty in getting signals in switching. The reverse lever has never gotten away from me at any time. I do not want a power reverse lever installed on my engine.

CROSS-EXAMINATION

As to why I don't want it, it is not necessary to have it. I have never operated a power reverse gear. As to how I know whether I want one or not, it is easy enough to handle it the way it is. I would object to a power reverse gear on that engine. I have seen a power reverse gear on the Southern Railway. As to why I would object to it, for one thing the engine is small, we haven't got room for it. As to whether it takes more room for a power reverse gear than for a hand reverse gear, these engines are so constructed that it would be hard to get them on. They are not like a rod engine, the links are all close to you, and the reverse bar is close, and you don't have to pick up the weight of them to reverse it backwards. They are

just straight across, and you just slide the link across. You don't have to pick up the weight of it either way. I have operated other kinds of geared engines, but geared engines are the only kind I have ever operated.

(Witness excused.)

J. C. Mayo, Schuyler, Va., age 48, engineer on the Nelson & Albemarle Railroad, testified:

DIRECT EXAMINATION

I have had 12 years' experience as an engineer, six years in regular service on the road and six years of yard service switching. I have had ten years' experience as a fireman. All of my time has
1205 been on the Nelson & Albemarle Railroad. The Nelson & Albemarle runs between Warren, Va., and Rockfish, Va., 20 miles. That territory is rolling and hilly. We have only one road engine and five engines in switching service. They are the Vulcan, saddle tank engines. We don't have any tender with those engines. Those engines are reversed with hand levers. I call them reverse levers.

I switch about two hours each day. I work six days a week, 11½ hours a day, from 6 o'clock until 5:30. I report for duty at 6 o'clock in the morning and start out on the road at 7.

The reverse lever on those engines is opposite the seat box, to the left of the engineer's seat box. We have an ordinary stationary seat box on those engines. I carry tools underneath the seat. There is plenty of clearance around the reverse lever and with relation to the engineer's seat box. The reverse lever does not interfere in any way with my getting to the instruments on the boiler head, or with my reaching the brake valve. I operate my reverse lever sitting down. I sit down all the time when engaged in switching service. I have about 50 percent back-up switch movement. I sit down then. I have no difficulty in getting signals from the men on the ground in that service. In back-up switching service I operate the reverse lever from the seat box. The reverse lever has never gotten away from me. I have never been injured by one of them. I have never had to have assistance in operating one of them.

We do not cross any railroads on the Nelson & Albemarle Railroad. There are two State highway crossings on that road, and quite a number of county roads and farm road crossings. I have no difficulty in looking out for those crossings and operating the reverse lever. I have never had an accident due to my failure to properly observe those crossings. I have had no accidents with those engines at all. I have never been injured by a reverse lever (tes., pp. 4184–4194).

1205 The reverse lever has never gotten away from me. I have never had any experience with a reverse lever jumping out of the quadrant. It has never threshed backward and forward in the quadrant with me.

I have seen a power reverse gear. I have never asked to have a power reverse gear put on those engines. I have not had any difficulty at any time in operating the hand reverse lever on that engine. Very little strength is required to operate that reverse lever. I weigh 175 pounds. I don't think there is any place on that engine where a power reverse could be installed. I never had a reverse lever break with me.

CROSS-EXAMINATION

There might be room in the cab of our engines for the quadrant of a power reverse and the small operating lever as I have seen them, but I don't think so. We have a lever and a quadrant in there now, but you see we would have to have space somewhere for the piston. As to whether I understand that the piston is in the cab, I don't know where you would put it on the outside, because our engines are all saddle tank. So far as the room in the cab is concerned, there would be plenty of room there for the power reverse gear.

There are no occasions that I know of when I find a hand operated lever harder to work than others. As to whether anything makes any difference in the way they handle, it can make a whole lot of difference, but we look after that pretty good. I have not observed any such thing.

(Witness excused.)

J. H. KEISLING, Livingston, Tenn., locomotive engineer on the Tennessee, Kentucky & Northern Railroad, testified:

1207 DIRECT EXAMINATION

I have been an engineer on the Tennessee, Kentucky & Northern regularly for six years. That road is located in the north central part of the State of Tennessee. It runs between Livingston and Algood, Tenn., 19 miles. The territory through which it runs is hilly. We have two 55-ton, 10-wheel Rogers locomotives. That 55 tons is the total weight. I do not know what the weight on the drivers is. The engine is hand-reversed. I work about 6½ hours a day. At the present time I am working three days a week. Ordinarily, when business is good, I work six days a week. At the present time we haul anywhere from one to four cars per trip with that engine. When business is good we will handle six loads one way and seven the other. I go on duty at 7:30 in the morning. I report 30 minutes before I leave with the engine. I oil up the engine during that 30 minutes.

We have the regular stationary seat box on that engine. The reverse lever is a little to the left and forward with reference to the seat box. I imagine there is about five inches clearance between the reverse lever and the side of the box. That is ample clearance for me. I have no difficulty in reaching any of the instruments on

the boiler head. The reverse lever does not interfere with my reaching the brake valve in any way. Part of the time I sit on the seat box when operating the reverse and part of the time I stand up. I usually do my standing up in switching. I have both back-up and forward switching movements with that engine in my switching work. I stand practically all the time. As to whether I have any difficulty in getting signals from men on the ground in back-up switch movement and at the same time operate the reverse lever, I can't see out when I am holding the lever and reversing, because I am on the inside of the cab; you can't see over the tank. As to my practice in getting the signals and reversing my engine, if I
1208 have been going ahead in forward motion I look for signals until I get a signal to stop. As soon as I get a stop signal I usually reverse the engine, knowing that they are going to back up—I figure it that way—I will reverse the engine, and then look out for signals; and when I get a signal to move I move the engine. I switch my signals before I move my engine. I have never had any accidents due to a slip-up or failure to get the proper signal. I have had no accidents to my engine of any kind.

I have never been injured by a hand reverse lever. It has never gotten away from me while I was operating the engine. It has never threshed backward and forward in the quadrant on my engine. It has never broken with me. We have no trouble in my territory with foaming water. I had one dry pipe leak. I put the engine out of service after we ran it one day. That leaky dry pipe didn't have much effect, if any, hardly noticeable, on the operation of the reverse lever. When I discovered the leaky dry pipe and put the engine out of service, the defect was repaired. I have never had any difficulty in clearing my cylinders of steam, or with the valves becoming dry. I have never had to be relieved from duty on account of fatigue due to the operation of the hand reverse lever. I have ample time to perform my usual duties as engineer and operate the reverse lever by hand. The hand reverse lever is not hard for me to operate.

I have seen a power reverse gear and have operated one. I have never asked that a power reverse gear be installed on my locomotive. I don't care whether a power reverse gear is installed on my locomotive; it don't make any difference to me. I don't know that it would help me any at all; I don't figure that it would.

CROSS-EXAMINATION

If I should fail to look out and check my signal before I moved in switching service, there would be opportunity that I might
1209 overlook my signal and get in trouble. On the occasion I had the leaky dry pipe, the lubrication was not so good; it made the reverse lever rattle in the quadrant a little. I couldn't tell any difference in the amount of strength it took to handle the lever. There are no variations in the way the hand lever handles from time to time, as I have experienced it, except that if I had steam in

the cylinders it would be harder; I mean when the relief valve is open and there is no pressure in the cylinder. Our counterbalance springs very seldom get out of adjustment and make it harder to throw the lever. I have had them get out of adjustment a little bit.

(Witness excused.)

J. A. BOATWRIGHT, master mechanic for the Tallulah Falls Railroad, testified:

DIRECT EXAMINATION

I have been master mechanic for the Tallulah Falls Railroad about 17 years. Prior to that time, I had a number of years railroad experience as foreman and machinist on the Southern and several other roads. As master mechanic on the Tallulah Falls Railroad, I have operated an engine in the capacity of an engineer. Freight and passenger service is performed on the Tallulah Falls Railroad. That road runs between Cornelia, Ga., and Franklin, N.C. That territory is hilly. We have five locomotives—two Consolidation 2–8–0, one 2–6–0, one 4–6–0, one 4–4–0—all hand reversed. One of them is Walscheart valve motion and one is Stephenson link motion. They are slide valves (tes., pp. 4194–4205).

We haul two cars in the passenger train, and I should judge it would average about eight freight cars. Some days we have three and some days we have 10 or 12. Our passenger trains will average about 22 or 23 miles an hour I guess, and our freight
1210 trains just about the same. We have cars to switch out and pick up on that road. The passenger engine spends no time in switching except when putting his engine away in the afternoon. The freight trains spend between four and five hours a day in switching, I judge. We have two regular engine crews, one for freight and one for passenger service. The freight-engine crew averages about 9 hours work a day. All our work is performed in daylight. Our engineer has to report for duty something like 30 minutes prior to the time the train leaves. He oils around his engine and inspects it before he leaves.

The reverse lever is located on the right side of the cab of the freight and passenger engines on that road. I think there is plenty clearance around the reverse lever with relation to the engineer's seat box. I found it so when I was operating the engine. I weigh 220 pounds. One of our engineers weighs about 125, I should judge, and the other one about 160 or 170. When the reverse lever is in the extreme back motion, I have not noticed the engineers have any difficulty in reaching the appliances on the boiler head. I had no difficulty when I was operating the engine in that respect. The lever is out of the way of the brake valve and does not interfere with the brake valve.

When I was operating the freight engine I have operated the reverse lever while sitting on the seat box. I have seen our freight engineer operate it both ways, sitting and standing. When he is

switching he would operate it while standing up. When he is switching he gets the signals from the man on the ground. We have had no accidents on the road that I know of due to the failure of the engineer to get the proper signals from the man on the ground while switching. Neither our freight nor our passenger engineer has had to be relieved from duty on account of exertion due to the operation of the hand reverse lever. I know of no instances when
1211 the hand reverse lever has gotten away from the engineer. We have not had a hand reverse lever to break on our road since I have been there. I know of no instances in which the hand reverse lever has jumped out of the quadrant on our locomotive. We have had no men that I know of injured by reason of the operation of a hand reverse lever on our road since I have been connected with it. I have never been injured by the hand reverse lever. None of our engineers has complained to me at any time about being required to do an excessive amount of work in operating the hand reverse lever. They have not asked us at any time to have power reverse gears installed on any of our locomotives.

CROSS-EXAMINATION

I don't know whether all our engineers belong to the brotherhood or not, but I think some of them do. We do not have a chairman who deals with me. Our engineers have a regular form of work report they give to me with respect to reverse gear. I don't recall anything they have asked to have done on the reverse gear except sometimes the reverse lever latch becomes worn. A worn latch makes the lever chatter, which causes a tendency for the dog to come out of the quadrant. We do not have to adjust the counterbalance spring very often. If a counterbalance spring gets out of adjustment, it makes a difference in the handling of the lever. I have had some experience with broken strips or a plug coming out of the pressure plate in our slide valve engines. If a strip should break while the engineer is handling the lever, it would have a tendency to pull him. We have no piston valves.

(Witness excused.)

L. B. Woodward, general manager of the Buffalo, Union-Carolina Railroad, testified:

1212 DIRECT EXAMINATION

The Buffalo, Union-Carolina Railroad runs between Buffalo and Pride. I have been general manager of that road between six and seven years. That road operates 19.3 miles of main track and 2.6 miles of sidings. The territory through which it operates is generally rolling. We have three hand-reversed, Stephenson-slide valve locomotives, two available for service. None of them is superheated. Our engineers are on duty between 7 and 7½ hours per

day. We have only one crew. About two hours a day, seven days a week, are spent in switching.

Our locomotives have a hinged seat box with an iron rod support. The reverse lever is to the left forward with reference to the engineer's seat box. I have never operated one of those engines in the capacity of an engineer, but have operated one taking the place of the engineer. There is about six or eight inches clearance around the reverse lever with relation to the engineer's seat box. When operating the engine I found the clearance ample. Our engineer weighs about 170 pounds. I weigh 155 pounds. He has never complained of the clearances being too close around the seat box. When the lever is in extreme back motion I have no difficulty in reaching any of the appliances on the boiler head or the brake valve. I have had no complaints from the engineer with reference to difficulty in reaching any of those appliances. I have observed our engineer operating the reverse lever. He can operate it from the seat box; he operates it both ways. He operates it standing up, generally in switching. About 50 percent of our switching is performed in a back-up switching movement. When the engineer is in a back-up switching movement he gets the signals from the men on the ground. Since I have been general manager of the road there have been no accidents, to my knowledge, due to the failure of the engineer to get the signals from the men on the ground in
1213 such switching movement. We had a little crossing accident—when I struck the automobile and caused $5 property damage.

We have had no engineers injured by a hand-reverse lever. We have had no complaints from our engineers with reference to having to operate these engines with the hand-reverse lever. They have never asked us to install power-reverse gears. I imagine our engineer is 53 or 54 years of age. He has been running as an engineer about 26 years. He has been with the company ever since it was organized in 1900. I do not know at any time when the reverse lever has gotten away with the engineer when he was hooking up the engine or letting it down. I know of no time when the reverse lever has broken more than a latch being worn. The Johnson bar did not break. We have had no complaints from our engineers with reference to the Johnson bar threshing backward and forward in the quadrant.

CROSS-EXAMINATION

We have a master mechanic on our road. It is the duty of the engineer to report any difficulties they are having with the lever to him; they make a daily report on the regular form. The detail of those reports would not come to my attention unless it is some repair of a large nature. The engineer is instructed to report all unusual happenings with his locomotive to me. If his reverse gear was threshing backwards and forward or getting away with him, he

would mention it to me. I don't know that I have instructed him to report that to me in that particular instance. My instructions are general; if anything unusual happens to the locomotive, I would like to know it. I would know every time the engineer has dry valves. They have never reported it, but in a matter of that kind it would be reported to me. I don't think we have had dry valves on our road since I have been general manager (tes., pp. 4205–4217).

(Witness excused.)

1214 B. C. THOMPSON, Oneida, Tenn., locomotive engineer on the Oneida & Western Railroad Company, testified:

DIRECT EXAMINATION

I have been engineer and master mechanic 17 years and engineer for 12 years on the Oneida & Western. That road runs between Oneida, Tenn., and Jamestown, Tenn., 38 miles. That is mountainous territory. We have mixed service on that road. We have one locomotive that has a power reverse on it and the others are the hand reverse. I have operated both types. Engine no. 20 has the power reverse gear on it. That gear was put on about 5 years ago, since it was acquired by the Oneida & Western. I operated that engine before it had the power reverse gear put on it, and I have operated it since. I have operated it in switching service both prior to and since the installation of the power reverse gear. I can reverse that particular engine in switching service quicker by the hand reverse.

I am on duty about eight hours a day at the present time. About two hours of that is spent in switching service. That service is performed in the day time. I have operated the other locomotives on this road that are hand reversed in switching service. I use the seat box most of the time in switching service, back-up switching movement as well as forward switching movement. While sitting down in switching service, I can operate the reverse lever from the seat box. I have no difficulty in doing that and getting signals from the man on the ground; you have got to throw it back and look back for the signal if they are behind you. I have had no accidents due to my failure to catch the signals from the men on the ground in switching service.

I have had one accident since I have been running as an engineer on that road. A fellow was drinking and ran right in front of me.

1215 He was not walking on the tracks, he walked right up what we call a scale track in the yard at Oneida, and the scale track came in to the main line. In place of stopping where I thought he would he just stepped right over. I saw this fellow before I hit him, I saw him just before he stepped over. He was coming up on my side.

I have had no accidents on our road due to my failure to keep a proper lookout for signals and road crossings since I have been on the road.

My experience with the power reverse is that it has to be repaired just the same as the other. It is all right when it is in good condition. I have had experience with it creeping.

I operate the hand-reversed engines on our road when the other engine is in the shop for repairs and inspection. I have never asked that the hand-reverse engine be equipped with power reverse gear. I did not ask that this engine no. 20 be equipped with power reverse gear. The superintendent of the road had it put on. The engine was sent in to the shop for repair and when it came out it had the power reverse gear on it. I really can't say what kind of power reverse gear it is. It has overhead valves, but I can't tell you any more.

I have never had a Johnson bar get away from me while I was hooking up the engine. When I was dropping it down I had one get away from me. The rod that goes through the counterbalance spring had broken since I had reversed the engine, and when I pulled the latch out of course it went over plumb down in the corner. It didn't hurt me at all. I finished my trip with the engine. I have never had the Johnson bar go from one corner to the other. I have never been injured in any way by the hand reverse lever, or the power reverse gear.

CROSS-EXAMINATION

This power reverse gear that I have is operated by a lever in the cab. I would not say how long it takes to throw the engine from forward motion to back motion with it, but it is very slow. 1216 It would not take any three or four seconds from forward to back. I never timed how long it takes to throw a manual-lever engine back. If it is working all right a man can throw it back mighty quick. There is very little difference in the time it takes to perform either one. That difference is the only thing I had in mind when I said I could switch faster with the manual lever.

When the man was hit in the yard, I was sitting there going very slow up through the yard. The bell ringer was going, and I swiped the gauge and stopped as soon as I could. I put it in emergency. There was a power reverse gear on that engine.

The power reverse gear is just like all other parts about a locomotive, they will wear, and they have to have either new parts or the old ones repaired once in a great while, not very often.

When the lever got away from me, I pulled the latch out and it went over from me in the forward motion. It went down with enough force to have jerked me if I had had hold of it.

(Witness excused.)

A. C. BLALOCK, Warrenton, N.C., superintendent and agent of the Warrenton Railroad Company, testified:

DIRECT EXAMINATION

The Warrenton Railroad is three miles long and runs between Warrenton, N.C., and Warren Plains, N.C. The territory through there is a little hilly. We have one locomotive, a Baldwin, 4-4-0 type, hand reversed, Walscheart valve motion, slide valve. That engine is used in more switching service than main-line service. It is used both in switching and road-house service. It operates six days a week. The engineer is on duty 10 hours per day and is on the engine working about seven hours average.

I know the location of the reverse lever in the cab of the engine. It is to the left of the engineer's seat box. I think
1217 there is a clearance of about six inches around the reverse lever with relation to the engineer's seat box. I have never operated that engine myself. I have observed the engineer operating it. He operates the reverse lever from the seat box when he is switching, even in a back-up switching movement. So far as I know, the engineer has not had to have assistance in operating that manual reverse lever. Our engine is equipped with a foot brace. I can't say whether the engineer uses it at all or not.

Our road does not cross any state highways. We have 11 other road crossings, all at grade. We have no block signals or other signals on our line. We have had no accidents since I have been connected with the road due to the failure of the engineer to keep a proper lookout for crossings (tes., pp. 4217–4229).

We have had no engineer injured at any time by the use or operation of the manual reverse lever. The engineer reports any defects in the engine directly to me. He has never reported that the manual reverse gear threshes backward and forward in the quadrant. He has never reported the reverse lever as jumping out of the quadrant when he was hooking up or letting down the engine. He has never reported the reverse lever as having gotten away from him while using it. I never heard of the reverse lever breaking on that engine; it would have been reported to me if it had. Our engineer has never asked us to put a power reverse gear or an automatic fire door on this engine.

CROSS-EXAMINATION

The engineer has reported nothing as needing attention on the reverse gear. That goes for my entire experience in the position I hold, that he has never told me anything about items of work needed on the reverse gear. He has been required to report such items to me a little over six years. He has never told me that the counterbalance spring needed tightening up or adjustment, never mentioned it in any way. He has never mentioned the latch
1218 to me, suggesting that the teeth were worn. I can't say whether we have had work done on the latch or the counter-

balance spring adjusted. Our engine was in the Seaboard shop three years ago and had a general overhauling. It was also in the Seaboard Air Line shops about 2 years prior to that time, and everything that was necessary in the way of repairs was done at that time. I would say it has run about 18,000 miles since the last time it was in the shop. I will state that we have had work on the engine since that time. We had a boiler maker and two mechanics work on it in June, to make all necessary repairs, and any time that any repairs are necessary that cannot be made by the enginemen we get a boilermaker, or whoever else is necessary, from the Seaboard shops to come and make these repairs. We had the reverse gear repaired when we had that done if it was necessary. I can't say whether it was necessary or not.

(Witness excused.)

J. A. McDermott, vice president and general manager of the Artemus-Jellico Railroad, testified:

DIRECT EXAMINATION

I have occupied the position of vice president and general manager between 7 and 8 years. I had not been connected with that railroad at any time prior to becoming vice president and general manager. As vice president and general manager I spend some of my time riding on the locomotives of that road. That road runs from Artemus, Ky., to Anchor, Ky., 11.4 miles, 4 percent maximum grade. We have freight service on that road. We have two hand reversed locomotives, slide valves. We haul from 15 to 33 or 34 cars to a train.

Our engineers are engaged in switching practically 50 percent of the time. They are on duty an average of 8 hours a day. They operate from 3 to 5 days a week. We are operating three
1219 days a week at the present time. All our work is done in the day time. Our engineers have to report for duty 30 minutes prior to leaving time. He has to fix up his engine between the time he reports and the time he leaves.

I am familiar with the location of the reverse lever in the cab of the engine. It is to the left, just a little forward, with reference to the seat box. The reverse lever is about three inches clearance from the boiler and about seven inches from the seat. During the time I have been riding on this locomotive, I have observed the engineer in the performance of his duties on each locomotive. The reverse lever does not interfere with the engineer's getting to the appliances on the boiler head, or to the brake valve.

We have a master mechanic. Our engine crews make daily work reports directly to him. He brings them to me the following morning and takes them up and gets approval of the work to be done, and makes a notation on it when it is done and returns those work sheets to the office. I keep them in my office on file. I know what work is being done on the locomotives all the time. As to whether

I have any recollection of any engineer reporting that the reverse lever has gotten away from him at any time, before coming down here I checked them two years and there was nothing in the record to show. I have no recollection of any such occurrence prior to that time. I have no knowledge of the reverse lever being reported as jumping out of the quadrant, no such report on record.

My observation is that the engineer is mostly standing when he operates the reverse lever in a back-up switching movement. He gets the signals from the men on the ground. We have never had any accidents on our road due to the failure of the engineers to get signals from the men on the ground in such a switch movement.

We have had no accidents on our road due to the failure of
1220 the engineer to keep a proper lookout for road crossings or highway crossings of any kind. We have no trouble in our territory with foaming water. We have never had an engineer injured by the operation of a manually operated reverse lever.

CROSS-EXAMINATION

If the lever got away from an engineer or jumped out of the quadrant, I think he would report that on his daily work report. Anything about the engine that needs the attention of the master mechanic is to be reported. I think he would report a lever getting away from him if there was a cause for it. The intelligence of the engineers would lead them to report that. I don't know that I ever gave them any specific instructions relative to that particular thing. They never report the lever working hard. I checked for two years and there has been nothing reported about the manual lever. I do not remember any other occasions. I have no recollection of having had any work done on the reverse in the last two years. I never make any special investigation or inspection of the manual lever or the repairs to it or the condition of it myself personally (tes., pp. 4229–4238).

(Witness excused.)

July 31, 1931

F. C. WILSON, age 54, machinist engineer on the Hartwell Railroad, testified:

DIRECT EXAMINATION

I have been on the Hartwell Railroad about 25½ years. I run on that road now as an engineer and do the repair work also. The Hartwell Railroad is located in Hart County, Ga. It runs between Bowersville and Hartwell, a hilly territory. We have one locomotive, a Mogul, weight about 103,000 pounds on the drivers, hand reversed, Walscheart valve motion, slide valves. That engine
121 is not superheated. I have very little switching to do. It takes about an hour and a half to make a round trip. I make two round trips a day. As the work is now, about 10 minutes of that hour and a half is spent in switching.

The reverse lever is on the left-hand side of the engineer. We have a seat box on that engine. I suppose there is about 4½ inches clearance between the reverse lever and the engineer's seat box. I find that ample clearance for me. When I am operating that engine, I sit down over all the runs and work the reverse lever. I can work it with one hand either way backwards or forward, and watch back and handle the engine. I have no difficulty in getting to the brake valve, or in reaching any of the other appliances on the boiler head. That is right in front of my seat box and the independent brake valve right up to the left. The reverse lever never got away from me. It has never broke with me. I have never had it thresh backward and forward in the quadrant.

As to whether we have a foot brace on that engine, I tacked a little piece of wood there myself. I am kind of light. I have never had any accidents with that engine. The reverse lever has never injured me in any way. I have been running that engine ever since 1910, when it was built by the American Locomotive Works. When I am switching with that engine, I still sit down on the seat box, or sometimes I turn and stand on the edge of the window. As to whether I have any difficulty in getting signals from the men on the ground when I am doing that, if you don't get out where you can see them when that occurs, if they get behind the cars like a lot of switchmen will do, you have trouble, but if you get out in the proper place you won't have it.

CROSS-EXAMINATION

I use that foot brace which I tacked on. It helps me in handling the lever kind of bracing my leg. On a slick floor in
1222 the cab or anything of the kind, you can't pull anything with your weight. That is the reason I put it on there.

(Witness excused.)

J. M. HOPKINSON, superintendent of motive power on the Savannah & Atlanta Railroad, testified:

DIRECT EXAMINATION

I have been superintendent of motive power nine years, two years master mechanic. I have been with the Savannah & Atlanta practically 11 years. As superintendent of motive power, I have charge of the engine crews mechanically, and of the motive power on the road. We have 16 locomotives, and are using 8 at the present time. Those locomotives are used in through freight, mixed train, and switching service. Eight of them are equipped with air reverse and the rest are hand reverse. Some of those engines now equipped with air reverse were originally hand reversed engines. We bought five Mikados all equipped with air reverse. In 1930 I went to Cuba and bought two Mikados that were recently built with hand reverse. We

brought them to Savannah, superheated, multiple throttle, and air reverse. We have never used them when hand reversed.

The Savannah & Atlanta Railroad is 145 miles main line. Seven Mikados are used in road haul service at the present time. When business is good we use two of the 400 class for local freight service. None of the air reversed engines is used in switching service. All of them are used in road haul service. There will be one when we get it running that is air reversed, that is 309, a switch engine. We bought it in March and we are superheating it and putting on a throttle. The air reverse is already on it. We would not run it without an air reverse because it is too good an engine. We would not want the engine without air reverse as it is our heaviest
1223 engine. We would not buy a new engine unless we put it on.

You can put it on any sized engine, but some of our engines are not worth the air reverse. I don't think I would put it on one as small as our 18-inch engine. That is the 400 and the 100 class. I think those Mikados should have it. If I were ordering one of these 10-wheeled engines with 106,000 pounds on drivers, I would put air reverse on it. I don't think any of those engines we have with hand reverse ought to be equipped with air reverse because they are not worth it. I think they are in the capital account at about $2,000 each. They are just waste cars, they are small.

We have no particular trouble with the power reverse gear that we have. We thought we were having trouble with them. You take an engine without a local valve pilot and there isn't anything wrong with them. Now, you put a local valve pilot on them, and take the tape off of it, being inexperienced like I was, when you first get the air reverse, you would think it was creeping, the vibration of the valve motion would make the pilot hand show a little movement. That creeping is not enough to bother you in the operation of the engine. I thought that the gears were creeping, and I requested the Franklin Railway Supply Company to send one of their service men down there. He checked over the valve gear and we couldn't find anything wrong with it. We have the Alco and Ragonnet reverse gear (tes., pp. 4283–4248).

We have a record of one engineer who claims that he hurt his hand on a hand reverse, 114 I think it was. That injury was reported to the Interstate Commerce Commission. That is the only injury so far as I know with the hand reverse. We have had no men injured with the power reverse gear. The man that was injured was named Austin.

Some of our engineers that operate the engines equipped with power reverse gear at times also operate the engines that are hand reversed. None of them has requested us to equip any of these
1224 hand reversed engines with power reverse gear. I have no knowledge of any accidents when the engineers have had the Johnson bars get away from them while hooking up or letting down the engine. I have never had any complaints from them that the reverse levers threshed backward and forward on the quadrant

when in operation. The hand reverse gear is located generally to the left and front of the engineer's seat box. With the 100 class we have a world of clearance between the reverse lever and the engineer's seat box. The 400 class is a little close, I imagine about 6 inches. We have had no complaints from our engineers that those clearances are too close. We have had no complaints from them with reference to inability to reach the brake valve, or other appliances on the boiler head in those hand reversed engines.

It is the policy of our company in purchasing new equipment to purchase power reverse equipment. We would not buy anything unless it had that.

I have observed our engineers in switching with hand reversed engines. I go out and ride with them sometimes. They can and do operate any of those hand reverse levers from the seat box when they are in switching service, but sometimes a fellow does not want to sit down, he wants to stand up. They operate them both ways. I don't know of any accidents due to the failure of the engineer to get signals from the men on the ground in switching service.

I have operated the hand reverse lever around the shop and out with the men sometimes. As to why a hand reverse lever on the larger engines is harder to handle than on the smaller engines, you can take an engine and run it light and handle the reverse lever pretty good. Then, with a train behind it, it is kind of hard to handle. I imagine the load the engine is pulling makes the difference, because you take a switch engine, throwing the lever back and forward—the engineer handling a hand reverse with a switch
1225 engine—the engine practically stops in throwing it back and forth. When you are pulling a train and the throttle is open and the pressure on the valve, it is naturally harder to hook up. The size of the valve does not necessarily vary with the different sized engine, it is just according to the engineer that designs it, according to the travel and whether it is a piston valve or a slide valve. On five of our engines we have 11-inch piston valves and on two of them eight-inch piston valves. There is more area exposed to friction on the 11-inch piston valve than there is on the eight-inch piston valve. In moving the reverse lever on the 11-inch valve there would be some greater resistance than there would be on the eight-inch valve, but it would [be] so little that you couldn't tell the difference. The 11 inch would have a little more friction than the 8 inch. That all depends on the adjustment of the rings. You can take an 8-inch ring on an 8-inch valve and make it tighter than on the 11-inch valve. The rings on both valves should be fitted according to the same standard when they are turned out of the shop, and I believe they are, but sometimes a man might get a ring tighter. The links on an 11-inch and an 8-inch valve engine are just about the same. The tumbling shaft and the link hangers are the same size on our road. On five they are interchangeable and on two they are. Those five engines are the same class. I would figure that the links on those five engines are practically the same size as those on the two

engines. There may be a difference in the radius of the links. There is very little difference in the size of the links on these two heavy Mikados and these 10-wheeled engines. We have Walscheart valves on all except two.

(Witness excused.)

M. H. BELL, master mechanic and engineer on the Birmingham & Southeastern Railroad, testified:

1226 DIRECT EXAMINATION

The Birmingham & Southeastern is between Union Springs and Eclectic, Ala., 48 miles long. I have been master mechanic and engineer 18 years. I had some service on the Seaboard as fireman prior to that. The Birmingham & Southeastern runs through level country, just one hill. Our engine crews make one round trip a day over the road. It takes about 9 hours to make that round trip. We have four locomotives worked by hand and one by power reverse gear. The 75-ton engine, a new engine, was equipped with power reverse when it came to us. I have operated that engine. I have had no trouble with the power reverse gear. We have had no accidents with engineers since I have been on the road caused by the operation of the hand-reverse gear. I have never been injured with a hand-reverse gear. I have had no difficulty with the reverse lever jumping out of the quadrant or threshing backward and forward on the quadrant. I have never had a Johnson bar break with me.

The reverse levers are right on the left-hand side, slightly forward, of the seat box. There is about 6 inches clearance between the reverse lever and the seat box of our engines. I find it ample for my use. I have no difficulty in getting to the brake valve or any of the instruments on the boiler head. I do about two hours' switching per day, in back-up and forward movement. When switching in a back-up switch movement, I sit down on the seat box when I am handling the reverse lever; I just turn around the other way. I have no difficulty in operating the hand-reverse lever in getting signals from the men on the ground in the back-up switch movement. When in service on the road, I operate that reverse lever sitting down. I have a foot brace on my engine and use it. I have never had to have any assistance in operating the reverse lever. I weight 140.

1227 Our locomotives are equipped with Stephenson link motion and slide valves. I have had no accidents of any kind since I have been running as an engineer on that road. I have never been injured with a Johnson bar. No other engineer on that road has ever been injured with a Johnson bar that I know of.

Our road handled the material for the construction of the Martin Dam. There were something like 50,000 cars of material handled for that work, I guess. Those cars were handled, generally speaking, down a steep grade. We had no accidents in the handling of those cars at any time (tes., pp. 4248–4259).

(Witness excused.)

1228 Chicago, Ill., August 6, 1931

H. E. Dulmage

DIRECT EXAMINATION

Witness Dulmage stated that he was a resident of Amherst, Ohio, and was superintendent of the Lorain & Southern, a switching road 6.01 miles in length, and had been connected with that road for 14 years. He stated that the road owned two locomotives of the 0–6–0 type and that they are equipped with the manual reverse gear and the Stephenson link gear shift having slide valves. The reverse levers are located slightly forward and to the left of the engineer's seat box in the cab, giving a clearance of from 12 to 15 inches from the engineer's seat box. He stated that from his observation the engineers usually operated the reverse levers while standing up. In 1928 we had one case where the engineer claimed he received a hernia either from the manual reverse lever or climbing on or off the locomotive. He did not know when it happened, but the doctor told him he had a hernia and we allowed it, calling it throwing the Johnson bar. The engineer's name was John Leonhard, and he was paid $85.71 because of this injury. We have had no complaints from engineers with reference to the Johnson bar lever jumping out of the quadrant.

Over objection of Mr. McLaughlin the witness stated that they had no complaints from engineers to the effect that they did not have time to perform their duties as engineers and still operate the Johnson bar on manual reverse levers.

CROSS-EXAMINATION

In respect to the injury, the engineer advised that the doctor told him he had a hernia, and he could see no place he could have gotten it only at work, getting on or off the locomotive or throwing the Johnson bar. We took him at his word and reported it as throwing the Johnson bar and allowed the claim. We gave the man the full benefit of the doubt, or the Industrial Commission of Ohio might not have allowed his claim. The engineer had a surgical
1229 operation and was laid up about three weeks (T. 4272–4272).

Roy Burns

DIRECT EXAMINATION

Witness Burns stated that he lived at Port Huron, Mich., and had been an engineer on the Port Huron & Detroit for 6 years. This railroad is a switching road and extends from Port Huron to Marine City, 22 miles. The road has five engines of the 0–6–0 type locomotive which are reversed by hand and have Stephenson valve

motion or slide valves. The quadrant is about 4 inches above the running board of the cab and there is a clearance of about 10 inches between the reverse lever and the engineer's seat box. The Johnson bar travels in an arc of about 24 or 26 inches in moving from the extreme forward position to the extreme back position. Witness stated that he operated the reverse lever while sitting down and never had to have assistance in operating the reverse lever. He stated that in a back-up switching movement he turned around on the seat box and never failed to get signals from the man on the ground or had any accidents in operating the reverse lever in such a switching movement. He stated that the reverse lever had never jumped out of the quadrant nor had he been injured in any way by a manual reverse lever.

CROSS-EXAMINATION

The lever is about 3 feet above the footboard and when you put your hand on the top of the lever and pull it from front to back motion it will move about 26 inches. I can operate the lever with one hand all of the time. He stated that he had observed some difference in the operation of the lever between the extremes in temperature. He stated that the lever may be a little harder to throw in the winter than in the summer (T. 4272–4282).

W. M. SIGAFOOSE

DIRECT EXAMINATION

Witness Sigafoose stated that he lived at Elkton, Va., and that he had been an engineer on the Chesapeake Western for about
1230 ten years and prior to that had been a fireman for about six years. He stated that he was now running in freight service between Elkton and Mt. Solon, 36 miles. The road has five locomotives weighing about 147,000 pounds on the drivers and are reversed by hand. One of the locomotives has a valve motion and the rest have Stephenson. In freight service they usually haul about 10 cars and run from 15 to 18 miles an hour and spend about 3 hours in switching service. He stated that the reverse lever in center position is right across from the seat box. These locomotives have drop seats. He stated that he operated the lever either sitting down or standing up and that he had no difficulty in reaching the instruments on the boiler head or reaching the reverse valve on the engine and that he never had to have assistance in operating the Johnson bar. He stated that he had no difficulty in getting signals from the men on the ground when switching and operating the Johnson bar. He had never had the Johnson bar jump out of the quadrant nor had an accident of any kind nor has he been injured himself by the manual reverse lever (T. 4282–4292).

CROSS-EXAMINATION

When the lever is in full forward position I would say that it is about six inches from the boiler head. The only time I find the lever harder to handle is after the engine has been overhauled. Sometimes when they are just out of the shops I have had to use both hands to handle it. There is a clip that goes through the quadrant, but if it were not there the bar could not go over two inches further, and even then the top of the lever would be 4 inches from the boiler head. I have worked the lever when the valves are dry, and find that the bar works a little bit harder. I have reversed the engine with steam in the cylinders and have had to use both hands, because it works harder reversing against the steam pressure. I have also observed that the counterbalance helps you when you are pulling the lever up from the front corner. I have not noticed any variation in the amount of strength required to move the lever in cold
1231 weather as compared to hot weather. However, I have a warm place to take the engine out of (T. 4292–4302).

C. W. GROVES

DIRECT EXAMINATION

Witness Groves stated that he was a resident of Hooppole, Ill., and was general manager of the Hooppole, Yorktown & Tampico Railroad. He has been connected with that road since May 1922 and has operated a locomotive on that road on a mixed train when someone was sick or laying off. The road has one locomotive with a slide valve motion, Stephenson link, and has a manually operated Johnson bar. He stated that the engine did about one hour's switching each day and that no difficulty was experienced in getting signals from the men on the ground or in reversing the engine and that they had never had any complaints of any kind or any accidents because of the hand reverse lever.

C. C. RAY

DIRECT EXAMINATION

Witness Ray gave his residence as Dequeen, Ark., and that he has official positions with the Dequeen & Eastern, Texas, Oklahoma & Eastern, and the Oklahoma & Rich Mountain, and has been connected with those roads 28 years. The Dequeen & Eastern operates from the Arkansas-Oklahoma State line to Dierks, Ark., 76 miles. The Dequeen & Eastern has one locomotive which is equipped with a hand reverse lever and has a Richardson vacuum valve motion, which is a slide and a Walscheart gear. He stated the T. O. & E. has one locomotive weighing 84 tons on drivers and is equipped

with a hand reverse gear. The Oklahoma & Rich Mountain runs westerly from Page, Okla., to Pine Valley, 17 miles. It has one locomotive equipped with a manual reverse lever. He stated no complaints were ever made in regard to the condition of the manual reverse levers. None of them have broken, nor had they complaints about the Johnson bar getting away from the engineers, and the only accident reported was where an automobile ran into one of their locomotives, striking the engine on the corner on the fireman's side, and this was reported to the Interstate Commerce Commission (T. 4302–4312).

1232 EDWARD EVENSON

DIRECT EXAMINATION

Witness Evenson stated that he was vice president and general manager of the Ft. Smith, Subiaco & Rock Island Railroad, has been with that railroad 12 years and in addition had 15 years of prior railroad experience with other railroads. He is a resident of Paris, Ark. He stated that his railroad rendered daily passenger service by motor car and nominal mixed-car service by steam train about three days a week. This road has two locomotives of the Mogul 2–6–0 type equipped with hand-power reverse gear having slide valves, Stephenson link, and the engines are not superheated. When business is normal the mixed train carries from 6 to 10 cars and the engineer spends from an hour and a half to two hours switching. Witness stated that if any complaints were made concerning the locomotive they would be received by him. He stated that he had observed the engineer operating the locomotive and that in switching he usually handled the manual reverse lever standing up but out in road service he usually operated it while sitting on the seat box. He has received no complaints at any time from the engineer about the manual reverse lever interfering with the engineer getting to the appliances on the boiler head or the brake valve. No reports have been made about the reverse lever jumping out of the quadrant or threshing backward and forward on the quadrant, nor have they ever broken, nor has any engineer been injured by the manual reverse lever. He also stated that no engineer had ever requested the installation of power reverse gears on their locomotives. He stated that they had good water in that territory for boilers and that no accidents had occurred at railroad crossings with their steam locomotives.

CROSS-EXAMINATION

By Mr. MCLAUGHLIN:

"Q. In case the reverse lever would jump out of the quadrant, do you think that would be an item to put on the work report?

"A. I would think so. There has to be a reason for it, and
1233 I think he would put it on the work report."

O. J. THORSEN

DIRECT EXAMINATION

Witness Thorsen stated that his residence was at Wells, Mich., and that since April 1, 1920, he had been master mechanic of the Escanaba & Lake Superior Railroad. Prior to that he had railroad experience on the Chicago & North Western. He stated the E. & L. S. runs from Wells, Mich., to Channing, Mich., having a main-line mileage of 65 miles slightly upgrade westbound. This road has seven locomotives. Engines nos. 12, 14, and 17 are power reverse, one is a Ragonnet and the other two are Alco. Engine no. 12 weighs 107,450 pounds on drivers, no. 14 is a 4–6–0, weighing 108,000 pounds on drivers, no. 17 is an 0–6–0, weighing 146,000 pounds on drivers. The other 4 engines are reversed by hand, three of them have piston valves and one slide. Engine 14 has Walscheart valve gears and the rest of them have Stephenson link. Engines nos. 12, 14, and 15 are superheated. Engine no. 17 was purchased second-hand with power reverse gear applied. Nos. 12 and 14, gears were applied by our own company. He stated that their locomotives did 8 or 9 hours of switching service a day, six days a week, and any complaints about mechanical defects of the locomotives would be reported and called to his attention. No engineers at any time have complained about the Johnson bar or reverse lever interfering with their reaching the appliances on the boiler head or the brake valve. No one has been injured with either type of gear, nor have they jumped out of the quadrant or threshed backward and forward on the quadrant. In switching movements the engineers on the hand-reverse locomotives operate the reverse either standing up or sitting on the seat box and no accidents have occurred by reason of their failure to get signals from the men on the ground, nor have any of the Johnson bars broken (T. 4312–4322).

1234 CROSS-EXAMINATION

"Q. Do the engineers report any defects of any kind with the manual reverse lever?

"A. No; unless it might be rattling the reverse-lever latch pin or something like that.

"Q. Do they ever report any defective condition with the power levers?

"A. There are reports about creeping and play with the piston rods. New packing cups are put in, and that takes care of the creeping to quite an extent. With our manual reverse gears we watch the latches and repair them before they get worn very bad, because the effect of a worn latch would be to allow the reverse lever to drop down in the corner of the quadrant, and if that happened with the engine running it would go down with some force; and if

it happened unexpectedly, and the engineer happened to be in the path of the lever, he might get hurt.

"Q. Would not a weak or broken spring permit the latch to jump out and the lever to go down in the corner?

"A. Not a latch in good shape. The lever would fall in of its own weight."

PETE HEDGPETH

DIRECT EXAMINATION

Witness Hedgpeth stated that he was a resident of Rockport, Mo., and was general manager of the Rockport, Langdon & Northern Railway, which is 5.65 miles in length, running from Rockport to Langdon, where it connects with the Burlington. They have two locomotives. Locomotive no. 2 is a saddle-tank locomotive weighing 51,200 pounds, and the other locomotive is the American type 4–4–0 weighing 57,000 pounds. Both are hand reversed and have slide valves. He said that they had some switching to do on that road, and that he operated the reverse lever sitting down; and that he has never had any difficulty of any kind with a hand reverse gear; nor has any of the engineers been injured by them; but that he had some trouble with foaming water in his territory.

1235 W. I. WEBB

DIRECT EXAMINATION

Witness Webb stated that he was a resident of Grayson, Ky., and was general manager of the East Kentucky Southern Railway, 13.4 miles in length, extending from Grayson south to Webbville, Ky., through a hilly country having a maximum grade less than 3 percent. They have two locomotives, one a 4–6–0; the other a 2–6–0. Both are hand reversed. On this run the engineer switches approximately 20 minutes on an average of 2 days per week. There has been no accidents of any kind on these locomotives. No one has been injured by the Johnson bar or manual reverse lever, nor has assistance been required to operate it (T. 4322–4331).

Chicago, Ill., August 7, 1931

CHARLES C. STIFF

DIRECT EXAMINATION

Witness Stiff stated that he was a resident of Tomahawk, Wis., and was chief clerk of the Marinette, Tomahawk & Western and had been connected with that road for over 26 years. This road now is engaged entirely in freight service and operates between Harrison

and Bradley; Jersey City and Spirit Falls, and Somo Junction and Wisconsin Dam. It is a rolling territory. They have two locomotives; one is the 0–6–0 and the other is 2–8–0, and both have hand reverse gears with Stephenson link with a slide valve. They are not superheated, and the average train is about 5 cars. He stated that when there was anything mechanically wrong with the locomotive reported by the engineers it went to the superintendent, but that he had to check up the work that was done on the locomotive. He stated that they scrapped the old engine last year and that the latch broke on it one time when switching was being done at the paper mill but that nobody was injured; also that one of the other locomotives jumped the track and that the engineer was thrown by the sudden lurch sideways against the Johnson bar or reverse lever
1236 and possibly against the boiler to. He was laid up 2 or 3 days. Other than that there has been no complaints or injuries of any kind of the hand reverse levers. We have no difficulty in our territory with foaming water.

G. B. TESNER

DIRECT EXAMINATION

Witness Tesner stated that he was a resident of Manchester, Iowa, and was listed as agent for the Manchester & Oneida Railway, which is about 8.14 miles in length. This road has two locomotives which are manually reversed and usually haul about 4 cars to a train. One of our engines is an old Illinois Central suburban switch engine brought from Chicago. It is the 2–4–0 type. The other engine is 2–4–0 type. The reverse lever is located slightly forward and to the engineer's left. On engine no. 2 there is plenty of clearance, on engine 4 it is fairly close quarters. The engine is rigid from one end to the other, and it is coupled up very short. Our road has no block signals. It crosses one primary and three secondary State highways. No one has been injured in any way with the manual reverse levers on either of our locomotives.

CROSS-EXAMINATION

"By Mr. MCLAUGHLIN:

"Q. How close is the lever to you as you are sitting on the seat box, and the lever is in center position on the quadrant?

"A. On the no. 2 it is possibly about 15 inches clearance; on the no. 4 it is pretty close. When the lever is in the forward position it comes within 10 inches of the boiler head or any pipes, while on the no. 2 there is probably 20 inches' clearance. On the no. 4 when the lever is in the back position you would have to drop the seat to get behind the lever (T. 4331–4343)."

FRED J. MORGAN

DIRECT EXAMINATION

Witness Morgan stated that he lived at Natalbany, La., and
1237 was train master for the New Orleans, Natalbany & Natchez and that he had run an engine on that road for about 15 years. This road runs through a hilly country. It has 4 locomotives, one of them being the 2-8-2 type equipped with a power reverse, which is a Ragonnet. The other three engines have hand reverse. There is about 1 to 2 hours switching per day required. On the 2-6-0's the reverse sits right back of the boiler head by the seat box, which is stationary. On the others up by the boiler. There is only 6 inches clearance between the seat and the reverse lever. There is ample clearance for the operation of the engine on either reverse. We have never had any complaints about mechanical defects of the Johnson bar, now have the engineers had any difficulty in getting signals from men on the ground while operating the reverse lever, nor have we had any accidents due to failure to get signals from the men on the ground. No engineer has been injured in operating the manual reverse gear nor with the power reverse gear. Sometimes we would get an engine fresh out of the shop, and we would have to use that foot brace to throw the hand lever over for a trip or so, as it would be a little hard to reverse without a brace.

CROSS-EXAMINATION

"By Mr. MCLAUGHLIN:

"Q. You have found that sometimes with steam in the cylinders that these slide valves pull pretty hard, don't they and you have to take 2 hands?

"A. We don't want them to work so hard that you have to take both hands. You cannot do that and look around and take care of your work. If they become that way a report is made of it, either the spring would be tightened up or some adjustment made that would relieve such a situation.

"Q. In your judgment if the counterbalance spring is out of adjustment and you are having to do a full day's switching, you might strain yourself sometime or another if that is not taken care of?

"A. Yes, it is hard; if the counterbalance spring is not
1238 adjusted right. It does not make any difference whether your counterbalance spring is out of adjustment or not with the power reverse gear as the power reverse gets it over any way. I have never had any difficulty with the power reverse in getting it hooked up (T. 4343-4354)."

BURR I. CARTWRIGHT

DIRECT EXAMINATION

Witness Cartwright stated that he was a resident of Arcade, N.Y., and was master mechanic for the Arcade & Attica Railroad which runs for a distance of about 39 miles through a rolling country. He has been master mechanic for 9 years. This road has 3 locomotives of the 2–6–0 type and has two of the 4–6–0 type. All of them are hand reversed. They have Stephenson slide valves and are not superheated. About 4½ hours per day are spent in switching and the balance of 9 hours is spent in making the round trip over the road. Each train has from 8 to 16 cars. The hand reverse is located to the left of the seat box near the center but slightly ahead of the center. There is from 8 to 10 inches clearance between the reverse lever and the seat box when the seat box is up. The engineers operate these reverse levers either standing up or sitting down, generally standing up in switching service. We have had no accidents due to the failure of engineer to get signals from the men on the ground while switching nor has anybody been injured in any way by the operation of the manual reverse lever. We have 27 highway crossings all together. No reverse levers have ever gotten away from the engineer nor jumped out of the quadrant, nor have any reverse levers broken. No engineers have had to be relieved because of exhaustion due to the operation of manual reverse gears, nor have we had complaints concerning that kind of gear, nor have we been asked to install power reverse gears.

1239 CROSS-EXAMINATION

"By Mr. MCLAUGHLIN:

"Q. Would the engineers report to you that the lever got away from them or jumped out of the quadrant?

"A. It would be on their work report if it did jump out.

"Q. Will you say that in 9 years with those engines you have never had a report made out on those engines for the manual reverse lever?

"A. Yes.

"Q. Have the engineers ever by word of mouth asked you to do anything about the reverse lever?

"A. No. I have had occasion to make repairs on the manual reverse levers (T. 4353–4362)."

Chicago, Ill., August 8, 1931

JOHN S. OLSON

DIRECT EXAMINATION

John Olson lives at Manistee, Mich., and is superintendent of shops for the Manistee & Northeastern. He stated that he had been

in this position for 2 years and that prior to that time had been master mechanic for 14 years for the Minnesota Western and prior to that had been locomotive fireman and engineer on the Soo Line. The Manistee & Northeastern has a main track mileage of 70 miles and about 40 miles of branch line. This road has 8 locomotives equipped with manual reverse levers, slide valve, and Stephenson link motion. Engine no. 17 is a 4–6–0 weighing 76,000 pounds on drivers. No. 27 is an 0–6–0 engine weighing 108,000 pounds on drivers. Both these locomotives are used in switching service about 6 hours per day. Engine no. 12 weighs 98,000 pounds on drivers and engine no. 24 weighs 59,000 pounds on drivers. Engine nos. 8 and 9 are on the mixed run from Travers City to Provemont and Northport. They are the 2–6–0 engines weighing 90,000 pounds on drivers. Engine no. 18 is the 2–6–0 type weighing 90,000 pounds on drivers and is operated in local freight service, about 6 hours a day in
1240 road service, and about 2 hours in terminal service. Engine no. 26, known as the Consolidated, is a 2–8–0 type weighing 113,000 pounds on drivers. The reverse levers are located alongside of and to the left of the seat box. The levers can be operated while sitting down. In switching service the engineer usually sits down and straddles the lever. If there is anything wrong with the mechanical operation of the locomotive the engineer turns in reports which come under my supervision. We have no record of any cases where the reverse lever has gotten away from the engineer or where the Johnson bar has broken nor have any engineers been injured by the manual reverse gear. We have had no accidents due to the failure of the engineer to get the signal from the man on the ground in switching service. Our railroad crosses several state highways and other railroads. The railroad crossings are protected by interlocker plant which are manually operated. It is necessary for the locomotive to come to a full stop before crossing over. We have had two accidents at highway crossings where automobiles ran into the side of the trains but that does not come under my jurisdiction. We have not been asked to install power reverse gears on any of our locomotives.

CROSS-EXAMINATION

On the Soo Line we used to have some trouble with the reverse levers because of sticky valves or dry valves. If the latch and notches at the quadrant are not in good condition it causes the lever to go to the corner. It is my judgment that a lever which will jump out of the quadrant and go to the corner may result in a dangerous situation for this reason, if a man has his foot near it or arm anywhere about it, the lever flying over would injure the man or may throw him out of the front window, depending on what direction the engine was moving (T. 4362–4374).

1241 Salt Lake City, Utah, August 19, 1931

CHARLES F. THOMAS

DIRECT EXAMINATION

Witness Thomas stated that he was a resident of Nezperce, Idaho, and was general superintendent of the Nezperce & Idaho Railroad. This road runs between Craigmont, Idaho, and Nezperce, 13.80 miles. He stated that he had been connected with this railroad a little over 9 years. This road has one locomotive weighing 60,000 pounds on drivers and it is equipped with a hand reverse lever, slide valves, and Stephenson valve motion. The locomotive is used in mixed train service, it takes 2½ hours to make the trip and about 20 minutes is spent in switching service. The reverse lever is located to the left and a little back of center of the seat box. The seat box is the stationary type with a cushion on top and a tool box underneath. Our present engineer weighs about 200 pounds but has no trouble in regard to clearance between the reverse lever and seat box. The engineer is able to operate the lever sitting down and does so in switching service and has made no complaints about not being able to get to any of the appliances on the boiler head or brake valve by reason of interference from the Johnson bar or reverse lever. The only accident that we have had was where the locomotive was backing up switching empties into an elevator. There was a row of buildings on each side of the crossing and a lady drove an auto in front of the moving freight cars. We paid damages for that accident out of court. No one on our line has been injured with hand reverse gears at any time. Any deficiencies in the operation of a locomotive are reported on work reports which are made to me. The reverse lever has never gotten away from our engineers nor has it ever been broken. No request has ever been made to install a power reverse gear on our locomotive (T. 4374–4387).

1242 GEO. H. MILLER

DIRECT EXAMINATION

Witness Miller gave his address as Seattle, Wash., and occupation as assistant superintendent of the Pacific Coast Railroad. He has had 22 years' experience with that railroad. It runs from Seattle to Black Diamond on the main line with branches from Renton, Wash., to New Castle and from Maple Valley, Wash., to Taylor, Wash., 30 miles of main line and 19 miles of branch lines. This railroad has nine locomotives which are reversed by hand levers. They have Stephenson valve gear and slide valves. About 24 cars are carried on the average freight train. We have two 0–6–0 engines weighing 80,000 pounds on drivers used in switching service. The 2–8–0 engines are used on road service. The road crews are

on duty about 8 hours per day, and about 2 or 3 hours of that time is used in switching service. The seats on the locomotives are the drop-seat type, and the reverse lever is just opposite the seat to the left. Our locomotive engineers weigh from 130 to 180 pounds and have not complained about the clearance between the reverse lever and the seat box, nor have they complained with reference to the reverse lever interfering with the engineer getting to appliances on the boiler head or to the brake valve. The engineers usually stand up and look back for signals in operating the reverse lever in switching service. Some of the locomotives are equipped with foot braces. Our railroad crosses two other railroads. The Union Pacific crossing is protected by automatic power. The Northern Pacific crossing is protected by a derail for which the train has to stop. Our line has 22 miles of automatic block signals which require engineer to look out for signals. Since I have been assistant superintendent, there have been no crossing accidents and no engineer has reported the reverse lever as jumping out of the quadrant at any time or that the reverse lever has gotten away from them or that the reverse lever has threshed backward and forward on the quadrant. No man on our road has been injured in any
1243 way by manually operated reverse gear, nor have we had to relieve any engineer from duty due to exertion on account of operation of the reverse gear. There has been no request made for installation of power reverse gears on any of our locomotives (T. 4387–4395).

CROSS-EXAMINATION

"Ex. Rogers. Do you have any other supervising officials in the mechanical department other than the master mechanic?

"A. None, other than the master mechanic. The chief dispatcher rides over the road with the engineer about once a month to look over the condition of the road and the way the men work. He did report about men running with the automatic blocks against them. If an engineer sees a red board in front of him and runs past a signal he is disciplined for that, the fireman will be also. When I have been riding in the engine I have observed the engineer use the reverse lever and he had no difficulty with it. I am not familiar with the difficulty that might occur from dry valves. I have observed the engineer miss a coupling and having to reverse the engine rapidly. There never to my knowledge has been any complaint about the operation of the reverse gear with the exception of once or twice when the engine was newly overhauled. The engineer would come in and say by word of mouth shortly after the engine was overhauled that the reverse lever worked a little stiff.

"Q. Is there any requirement for the engineer to report the fact that the reverse lever dropped down a notch or two in the quadrant as they are running along?

"A. I would call that a defect. They are required to report it. The master mechanic requires a report of all mechanical defects that occur on the trip and if there are no mechanical defects the lever would not go down a notch or two in the quadrant.

"Ex. ROGERS. I thought you said awhile ago that you did discipline the fireman in that case?

"A. It must have been a misunderstanding. We did not discipline the fireman. The engineer was disciplined, but the
1244 fireman claimed he was down shoveling coal. We had nothing to show that he was not, and he was not disciplined any further than just taken up and told that he must do the best he could to look out for signals. No entry was made against the fireman's record. There was a brakeman on the engine at the time and he was taken up for investigation. The brakeman stated that he was looking back for signals from the rear end, so he was not disciplined any more than the fireman. No charge was made against the brakeman's record. These men lost no time on account of the investigation (T. 4395–4411)."

OVERTON HODGES

DIRECT EXAMINATION

Witness Hodges stated that he was a resident of Pratt, Kans., and has been connected with the Wichita Northwestern Railway since 1915 as master mechanic, superintendent of construction, and superintendent. He stated that he had also fired and run engines over this road. It runs from Pratt, Kans., to Vaughn and from Trousdale to Kinsley, the road being 100 miles long with a maximum grade of 1½ percent. The passenger service on this road is performed by motor cars. The freight service is performed by steam locomotives, of which we have 3 weighing 90,000 pounds on drivers. They are equipped with hand-operated reverse levers, having Stephenson valve motion and slide valves. None of them are superheated. Our trains haul from 8 to 12 cars. The engineers spend from 10 to 11 hours a day on duty, six days a week, and from 40 to 50 percent of their time is spent in switching service. Two of the locomotives have stationary seat boxes and the other one has a drop seat. The reverse lever is located to the left and a little forward of the seat. Our engineers weigh from 150 to 175 pounds and there is ample clearance around the reverse lever with relation to the engineer's seat box. I would say that the top of the Johnson bar is from 36 to 42 inches from the floor when it is in the center
position. I would estimate that the entire length of the arc
1245 made by the Johnson bar when it moves from the forward position to the extreme back position would be from 42 to 48 inches. Our engineers stand up practically all the time when they operate the Johnson bar. One of our locomotives has a foot brace

which helps to a certain extent in the operation of the Johnson bar. We have had no complaints from engineers that the Johnson bar interferes with their reaching the appliances on the locomotive. Our railroad crosses two other railroads. There are two crossings on the Santa Fe, one a hand-operated derail, and the other one has a derail or electric semaphore operated by hand. When our locomotives approach the Santa Fe crossing they have to stop and the brakeman goes ahead and throws the derails. We also have one crossing over the Missouri Pacific, which is not protected. When a locomotive approaches the Missouri Pacific crossing they stop and whistle for the crossing. The trunk lines have the right-of-way. One crossing is protected with a gate and derails and the other with automatic semaphore and block signals on the Santa Fe.

In switching movement there is a good deal of backing up, and on account of the size of the tanks the engineer would have his head out of the cab window most of the time. In a back-up switch movement, after the engineer gets the signal he would have to draw his head in the window and reverse the engine. After making the reverse, why, he would have to put his head out of the window again to see. We have had no accidents on our road due to the failure of the engineer to get signals from the men on the ground. We have had no complaints about the reverse lever jumping out of the quadrant or threshing back and forth on the quadrant or getting away from the engineer at any time, nor have any men been injured in any way by manually operated reverse gears. The Johnson bar has never broken with any of our engineers. In our territory the temperature ranges from 10 below zero to 110 above, and no difficulty has been experienced in operating the reverse lever due to temperature, nor has the engineer had to call for anyone to assist him handle the Johnson bar in reversing the engine. No request has been made from any of our engineers to have the locomotives equipped with power reverse gears (T. 4411–4421).

1246 CROSS-EXAMINATION

I have found if the hand lever gets too dry that it doesn't drop very well. If you are hooking it up running over the road with dry valves, there would be a tendency for the lever to pull out of your hands. You feel a jerking sensation when handling the lever under those circumstances. In my judgment, if the notches in the quadrant become round or the dog had worn thin, there would be a tendency to cause the lever to jump out of the quadrant and go to the corner. The same would be true if the latch spring was loose or had lost its tension. Since I have been with this road we have replaced one quadrant on one of the locomotives. If the counterbalance springs get out of adjustment, that likewise would contribute to a hard handling lever. It is more difficult to operate the lever with steam in the cylinder than ordinarily. Under those circum-

stances you would have to use both hands and brace yourself. I found it necessary to brace myself in order to handle the lever in switching service. When you have a backing-up movement in switching service you have to abandon your look-out for the time and put your head inside the cab to handle the lever. You can reach the throttle and the brake valve and things of that nature with a good clearance from the reverse lever. However, if you had to place your arm in the plane that the lever would travel as it went over the quadrant I think it would be a dangerous practice, because if the bar would slip out of the quadrant it might break your arm. If there happens to be steam in the cylinders and the engine is running it may be cleared by opening the cylinder cocks, but if you are at a depot platform or where people are around on the ground it might not be advisable to open the cylinder cocks.

Allan McNew

DIRECT EXAMINATION

Witness McNew stated that he had been in the employ of the Colorado & Southeastern Railroad for 21 years, serving as brakeman, hostler, fireman, conductor, and superintendent. This road runs from Trinidad to Hastings, Colo., 20 miles, and from Trinidad
1247 to Barnes, 6 miles. It is primarily a switching road, with a maximum grade of about 2 percent. It has three locomotives equipped with hand reverse levers and Stephenson slide valve. This road handles about 35 cars to the train. The crew works 8 hours, about half of which time is spent in switching. The reverse lever is located to the left and in front of the engineer's seat box. There is ample clearance between the reverse lever and the engineer's seat box. When the Johnson bar is in center position on the quadrant the top of the Johnson bar is about 40 inches above the floor of the cab and it does not interfere with the engineer getting to the appliances on the boiler head. In switching service it is more convenient to stand up in operating the reverse lever. None of our engineers have had to have assistance in handling the reverse lever. We have foot braces on our locomotives and that helps the engineer in operating the lever (T. 4421–4431).

At the mine the loads accumulate to such an amount that it is necessary to double over a few loads from one track and then pull the other track down and drop some loads off the first track. Occasionally where you could not start the bunch of cars the first time if the reverse lever would handle hard it would be on account of steam in the cylinders but have never had to call for assistance in operating the reverse lever under those circumstances. The only highway crossing accident that we have had in a good many years occurred in 1919. The engine was backing up pushing 20 loads of coal and at the grade crossing they struck an automobile which had

stalled on the crossing and pushed the automobile probably 5 car lengths before being able to stop. The automobile approached from the fireman's side but he could not see because it was on a curved track. Our road was called upon to pay damages but I do not know how much. The accident was reported to the Interstate Commerce Commission.

The temperature in our territory ranges from 15 degrees below zero to 95 above in the shade. We have had difficulty with the reverse lever threshing to and from on the quadrant and we
1248 have found this difficulty when the boiler is dirty and needs a washing out. We take the engine in and wash the boiler to get rid of the dirt so that it will not foam, then the threshing of the reverse lever on the quadrant ceases. We have also found that the valves become dry when the engine is working water or foaming and that after the boiler is washed out there is no more trouble with dry valves. We have not had to relieve an engineer on account of exertion in using the manually operated reverse gears, nor has anybody been injured by them, nor has any request been made by engineers for the installation of power reverse gears on our locomotives.

CROSS-EXAMINATION

When you have steam in the cylinder or the boiler was foaming the lever is harder to handle than ordinarily; also when the counterbalance spring is out of adjustment. In the winter time when it is 10 or 15 below zero the lever works harder than in the summer. This is due to the oil stiffening and you have to brace yourself because the lever throws harder. In our territory the boiler will stay in proper shape about a week after a washing out (T. 4431–4441).

William P. Nichols

DIRECT EXAMINATION

Witness Nichols stated that he was a resident of Weiser, Idaho, and was shop foreman for the Pacific & Idaho Northern and has been connected with that railroad for 30 years as fireman, engineer, and shop foreman. This railroad runs from Weiser to New Meadows, 90 miles. It has four steam locomotives equipped with hand power reverse gears and Stephenson slide valves. The freight trains haul on an average of about 12 cars. There seems to be plenty of clearance between the reverse lever and the engineer's seat box. When the reverse lever is in center position the top of the Johnson bar is about 4 feet above the floor and the middle of the quadrant is 12 inches from the floor to the highest point. When I was
1249 engineer I operated the reverse lever sitting down on the road but when I was switching I stood up. Three of our locomotives are equipped with foot braces. Some of those foot braces are put in the locomotive in order to assist the engineer in throwing

the Johnson bar. It keeps them from slipping and gives them a better purchase on the Johnson bar. As far as my knowledge goes no one on our railroad has ever been injured with a manually operated reverse gear. We have never had a Johnson bar get away from our engineers or jump out of the quadrant or thresh backward and forward in the quadrant. We never have had trouble in our territory with foaming water or leaky dry pipes as we renew the flues every four years. We use plenty of oil and seldom have trouble with dry valves. When I was engineer I never had trouble clearing the cylinders of steam, never had to be relieved due to exertion in the operation of a manual reverse lever, nor did I ever have a Johnson bar break. I always had ample time to perform the other duties of an engineer and still operate the manual reverse lever.

CROSS-EXAMINATION

I have found that the lever works harder when the links get dry or the valves. When you are running over the road if you handle the lever before the valves are well lubricated you can feel it jerking a little when you commence to handle the lever, but I have never seen any of our engines that I could not hook up with one hand.

"Q. When you are reversing the engine, making the coupling, and you miss the coupling the first time, you go back and get her again pretty quickly you find it takes a pretty good pull to handle the lever, under those circumstances?

"A. Not very much. As a general rule when I am running an engine I reverse it before she quits rolling. I pull her ahead two feet, start her ahead, and reverse her and she is ready to go back. When you lose a coupling you don't have to stop; you can pull ahead a little and reverse the engine and she is coming right back.

"Q. Have the engineers ever reported items for your attention with reference to the latch or the spring?

"1250 A. Yes; once in a while they get worn a little and I tell my engineer 'next trip report that latch and we will have it fixed up.' It will not last forever, a bolt will get worn and give a little slack and will jump out of the latch if it gets enough slack. I always looked after the heel bolt because I knew that the weight of the links would pull her down and that the lever would go to the corner. If the locomotive is running she would probably go to flipping (T. 4441–4454)."

EDWARD MEYERS

DIRECT EXAMINATION

Witness Meyers stated that he lived at Silverton, Colo., and is superintendent of the Silverton Northern and has been connected with that railroad in various capacities for 30 years. This road handles freight and runs between Silverton and Eureka, 9 miles.

It has three steam locomotives, only one of which is in service at present. It weighs 60,000 pounds on the drivers and has Baker valve motion equipped with slide valves. This locomotive is reversed by means of a hand reverse gear and is not superheated. The trains operated by this road carry about 10 cars to a trip. The crews work about 5 hours a day, three hours of which are spent in switching service. When the Johnson bar is in center position of the quadrant, the top of the Johnson bar is about 3 feet from the floor board and the quadrant is from 12 to 14 inches above the floor board of the cab. When the Johnson bar is moved from the extreme forward position to extreme backward position it travels in an arc of about 3 feet. This locomotive has a drop seat box and also foot braces. The foot brace gives you a better purchase on the Johnson bar and makes reversing easier. There is plenty of clearance around the reverse lever for the engineer in the performance of his duties. The witness stated that so far as his knowledge goes with anybody connected with that railroad no one has ever had to have assistance in operating the reverse lever. It has never threshed backward and forward in the quadrant, never broken, nor has it jumped out of the quadrant, nor has any one ever been injured in the operation of hand reverse gears.

1251 CROSS-EXAMINATION

In switching service the engineers usually brace themselves in handling the reverse lever as it would be a dangerous thing to slip on the deck of a locomotive when you are handling a lever. When steam is trapped in the cylinders the lever also pulls harder. If the valves are not well lubricated the lever will handle more difficult. Our water is first-class water, it never foams, and we have all the oil we need so we never have dry valves. If you should have the strip break while you are handling a lever it would be likely to give you quite a jerk. I think it would not be good practice to handle the lever when your valves are dry because it would be liable to drag you because of the friction in the valves. Cold weather stiffens your lubrication and that also makes it more difficult to operate the lever (T. 4454–4463).

E. V. Earp

DIRECT EXAMINATION

Witness Earp stated that he was a resident of Mack, Colo., and for over 15 years had been connected with the Uintah Railroad in various capacities in engine service. This is a narrow-gauge road running from Mack, Colo., to Watson, Utah, 63 miles through a mountainous country having a maximum grade of 7½ percent. This road has 10 steam locomotives, 8 of which are hand reversed and two equipped with power reverse levers. The locomotives reversed by hand consist of three Shay locomotives, the Consolidated 2–8–0 type,

the 0–6–2's and 2–8–2's. The two locomotives equipped with power reverse are Articulated Mallet or the 2–6–6–2 type. Three of our locomotives are superheated. The 0–6–2's are the saddle type locomotives and are used in work-train service. The 2–8–0 is a relief engine on a mixed run and the freight service. The three Shay hand reversed locomotives are used in freight service. Engine no. 50 was purchased in 1926 and engine no. 51 was purchased in 1928. Both are power reverse and were so equipped when acquired. The work engines do practically no switching. The Shay engines do about 35 minutes of switching to an hour a day. Engine no.
1252 40, weighing 86,400 pounds on the drivers, does about 30 minutes of switching to an hour a day. The two power-reversed engines do around 45 minutes or an hour's switching eastbound and very little westbound. The hand reverse levers are located to the left and slightly ahead of the engineer's seat box. In the Shay type engine they are located a trifle farther back. In switching service the engineers generally stand up in operating the reverse lever because they can see better to observe signals. There is ample room around the reverse lever for the engineer in the performance of his duties. Our locomotives are equipped with foot rests and that helps you in throwing the Johnson bar over as it naturally helps you to balance yourself a little better. Engines no. 30 and 40, 50 and 51 have Walscheart valve motion and the other locomotives are equipped with Stephenson valve motion. In all my experience with this road I have never had a Johnson bar thresh back and forth in the quadrant or get away from me while hooking up the engine or jump out of the quadrant. We do not have any trouble with water foaming, nor with leaky dry pipes and consequently the valves do not become dry. We have never had to relieve an engineer due to exertion caused by operating the hand reverse engine nor has any of them had to have assistance in operating the Johnson bar nor have any of the engineers been injured with either the hand reverse gears or the power reverse gears. Three percent grade is about the maximum that we can use engines nos. 12, 30, and 40. The power-reversed locomotives 50 and 51 we use on the heaviest grades. On one occasion we have an accident when I was running the engine. I ran into and smashed up two flat cars. We were moving very slowly, it was foggy and I did not see the cars until about 30 feet away. There was ice on the brake shoes and the power reverse was so slow to get over that I struck them. I used the air and emergency and when it did not take hold the air reverse was so slow that I did not get her over. We were just tipping over the top of a hill. I believe on that occasion I could have reversed the engine if it had been equipped with a hand reverse lever (T. 4463–4473).

1253 In regard to the three Shay engines, there is no place on those engines where the power reverse gear could be installed at all, and because of the limited space it would not be practical

to install power reverse gears on the saddle-tank engines. The power reverse gears which we have are the Alco type, and of course the engineer is dependent upon the air pressure for their operation. The power reverse has more mechanism and is more complicated than the hand reverse and requires more upkeep. Frequently they become out of order; much more frequently than hand reverse. Every few trips we have something on the power reverse. We have only had the one smash-up referred to, but sometimes we bump cars pretty hard. The principal difficulties with the power reverse are leaky piston packing, dirty air, and packing leathers.

CROSS-EXAMINATION

These power-reversed engines or Mallets are really two engines in one so far as the valve motion is concerned, so when the reverse gear is doing its work it is lifting the motion on two engines for all practical purposes. I have never timed it, but I do say that the power reverse is slower than the hand reverse. When I first observed those two cars at the time of the accident I jerked the brake valve and started to pull her over. There was too much ice on the shoes to get very good results out of the brakes. I just about got the reverse lever over when we hit the two cars. There is a difference in the time it takes to throw the hand-operated lever all the way over and to move the lever of the power reverse. I am speaking of the occasion when we ran into the two cars. The air pipe was broken plum off. If you had a train it would operate the brakes and emergency. We had a light engine movement and didn't have any success using automatic air on drivers; it is dangerous with our condition. I was looking at the air gauge at the time of the accident, and I just got her over as the air was all gone. They work on a few pounds. I had 110 pounds to start with, but I just had enough to get her over after the brake and it was gone.

1254 "Q. Did that set your brakes and emergency and stop the train?

"A. Yes, but that was on a 5 percent grade. It would not stop the train going down the 7½ percent grade. It would not stop the engine."

REDIRECT EXAMINATION

We have lost the air several times running with a hand reverse engine, but we do not thing so much about that. If you lose your air while operating the power reversed engine hauling a train of cars, your brakes would be automatically set going down the 7½ percent grade but the train would not stop.

"Q. It would not be any different if you were operating a hand reverse engine?

"A. Absolutely; we would not think anything in particular about that; we would reverse her and give her some steam and stop them.

"By Mr. McLaughlin:

"Q. You can stop a train on a 7 percent grade by reversing the engine without any air?

"A. With air going in.

"Q. Then you would have air also if it was a power reverse, would you not?

"A. But you would not get stopped with power reverse. Your train would not stop on a 7 percent grade (T. 4473–4487)."

San Francisco, Calif., *August 28, 1931.*

Robert Hansen

DIRECT EXAMINATION

Witness Hansen stated that he was a resident of Winchester, Idaho, and is general superintendent and auditor of the Craig Mountain Railway and has been for 7 years. Prior to that he had over 16 years' railroad experience with other railroads. The Craig Mountain Railway is located in Lewis County, Idaho, and runs from Craig Junction to Winchester, 5.59 miles. It runs through a rolling territory with maximum grade of approximately 3 percent. This railroad has one locomotive weighing 114,000 pounds on drivers and is used in freight and mixed train service. The trains
1255 average from 5 to 13 cars. Running time for the round trip requires about an hour, however, the engineer is on duty 3½ hours and from 15 to 40 minutes are consumed in switching service. This locomotive is equipped with a folding type seat box, and the hand reverse lever is located to the left of the engineer's seat box. The center of the quadrant is about 1 foot high from the floor board of the cab. When the Johnson bar is in center position on the quadrant the top of the bar is about 4 feet from the floor board of the cab. We have had no complaint from our engineer because of insufficient clearance around the reverse lever or with his inability to get to appliances on the boiler head. No one has been injured by the hand reverse lever, nor has any complaint been made with respect thereto, nor has the manually operated reverse lever ever broken. We have had no trouble with leaky dry pipes. Sometimes in the summer when the water gets low we have a little trouble with foaming water, and to remedy this we wash the boiler out more often.

James A. Drake

DIRECT EXAMINATION

Witness Drake gave his residence as Oakland, Calif. He stated that he was a locomotive engineer for the Howard terminal located at the foot of Market Street in Oakland and had been for about 8 years, and prior to that had been an engineer on the Milwaukee for

2 years and 2 months, and for about 6 years prior to that had been a fireman on the Milwaukee, the Soo Line, and the Great Northern. He stated that the service performed by the Howard terminal is exclusively inter-yard switching service. This company has two locomotives, one a 6-wheel switcher of the 0–6–0 type weighing 103,000 pounds on drivers and the other an 0–4–0 type weighing 56,000 pounds on drivers. These locomotives are the saddle tank type equipped with hand reverse gears having Stephenson link motion and Richardson balanced valves which is a type of slide valves. Neither engine is superheated. The engines usually handle 6 or 8 cars at a time but occasionally handle as many as 20.
1256 The engineers work 8 hours for 6 days per week and this is generally in the day time. The locomotives are equipped with leanback drop seats, the hand reverse lever is located to the left and possibly 9 to 12 inches forward of the engineer's position when he is sitting down. There is ample clearance between the reverse lever and the engineer's seat box. The center of the quadrant is about 2½ feet above the running board of the cab and the top of the Johnson bar in the center position is about 5 feet from the floor of the cab (T. 4490–4500).

The locomotive weighing 103,000 pounds on drivers has a false deck about 18 inches from the main deck of the cab. The purpose of that is to bring the floor of the cab up high to serve as a foot rest for the engineer. The reverse lever does not interfere with the engineer getting to the appliances on the boiler head. I find there is no difference in the operation of locomotives equipped with piston valves or those equipped with slide valves when they are properly lubricated. It requires little effort with our locomotives to operate the reverse lever either in reversing the engine or hooking her up or dropping her down. I operate the lever sitting down and have no need for foot braces. There might be a type of locomotive where foot braces would be necessary but that is not so with our locomotives. We hook the engine up a notch or two at a time. I don't have to change my position in hooking the engine up or dropping her down and can keep a look out all the while. We have an interlocker signal at one point. About 50 percent of our switching is performed in a back-up switching movement and I can get signals from the men on the ground while sitting down and operate the reverse lever at the same time. We have had no accidents due to the failure to catch signals. The Johnson bar has never threshed backward and forward on the quadrant, nor gotten away from any of our engineers, nor has it broken or jumped out of the quadrant. We have had no trouble with leaky dry pipes, foaming water, or dry valves. The temperature ranges from 60 to 65 above zero to around 85 to 95 above. I have never had difficulty in clearing the cylinders of steam. If people were near on the ground I would not clear
1257 the cylinders of steam until they got out of the way. I have not been injured by a hand reverse gear, nor have I been

relieved from duty on account of exertion due to their operation, nor has any one connected with our road been injured by a manually operated reverse gear. I would say that the manually operated reverse gear is a proper design for the locomotives which we use.

"By Mr. MILLER:

"Q. Have you ever been required to place yourself in a hazardous position in order to operate this manually operated reverse lever?"

Over objection by Mr. McLaughlin witness was allowed to answer.

"I have not."

The witness stated that their locomotives were equipped with an improved type of steam brake. The witness testified that he was familiar with the power reverse gear, having had experience with them while working for the Milwaukee road. He stated that he could reverse the locomotive more quickly with a hand reverse and that in switching service there was often a necessity for being able to reverse quickly (T. 4500–4511).

CROSS-EXAMINATION

In the service that these engines perform, which is among docks and warehouses, where there is a certain amount of dirt you will be going along and your brakes are holding fine; then, the first thing you know you haven't got anything under you at all. Naturally, your drivers skid. Many times you haven't time to get her swung clear over. You know it takes a few seconds to throw the lever over. If you can throw the lever over, get a little steam then, barely enough to throw her backward, you can stop. That requires a pretty rapid movement of the bar and often occurs when you have missed a coupling. Sometimes a number of movements of the reverse lever are required before you finally succeed in making the coupling. During those times when you are trying to make the coupling you are moving in a short space to get rid of the steam in your cylinders. The lever handles harder when you have steam in your cylinders.

1258 On the Milwaukee the piston-type engines that were equipped with manually operated reverse levers weighed about 225,000 on the drivers and, of course, it took more strength to handle the reverse lever there than it does on our engine weighing 103,000 pounds on drivers. The heavier locomotives had foot braces and we would brace ourselves against them. If a locomotive is not well counterbalanced it will pull harder going in backward motion than in going into forward motion. If you are out on the road handling a lever in hooking the engine up which had a bad adjustment on the counterbalance spring there would be a tendency to jerk.

"Q. I don't suppose you ever had any trouble with the power gear while you were on the Milwaukee?

"A. The only trouble we had there was with the two-cylinder type, the Mellin gear. If you get a little oil out of the oil cylinder

they would slump when you first put it in. From my experience I have found that if you have trouble lubricating your valves the effect will be to make the reverse lever handle harder (T. 4511-4518)."

ALBERT KOHLER

DIRECT EXAMINATION

Witness Kohler stated that he was a resident of Silverbell, Ariz., and was superintendent of the Arizona Southern and also of the mines at Silverbell. He has been connected with the railroad for 14 years. The Arizona Southern is located in Pima County, Ariz., and runs from Red Rock to Silverbell, 20.5 miles, 17 miles of this is through a desert country and the balance is mountainous with a maximum grade of about 5 percent. The road has two steam locomotives of the Consolidated 2–8–0 type weighing about 130,000 pounds on drivers. They are not superheated and are equipped with hand reverse levers having Baker motion and slide valves. The locomotives are used in freight and mixed service. The maximum number of cars handled are six 50-ton gondolas, two water cars and one caboose. Under normal conditions the engineer will work
1259 from 5½ to 6 hours a day, about 30 minutes of this time is spent in switching service. The engineer's seat box is a drop seat with a back. The reverse lever is to the left of the engineer's seat box. The center of the quadrant is about 8 or 10 inches from the floorboard of the cab and in the center position on the quadrant the top of the Johnson bar is from 4 to 4½ feet from the running board of the cab. Witness stated that the engineers operate the reverse lever sitting down, except in backing-up switching service when they most generally stand up. These locomotives are not equipped with foot braces. There has been no complaints with reference to the Johnson bar interfering with the engineer getting to other appliances on the boiler head. No engineer has had to be relieved on account of exertion in operating the reverse lever nor have they had to have assistance in operating the same. No requests have been made for the installation of foot braces. This railroad crosses one State highway and two county highways but has not had any accidents at such crossings. No complaints have been made with reference to the reverse lever threshing back and forward on the quadrant or jumping out of the quadrant.

Over objection of Mr. McLaughlin the witness was allowed to state that the reverse lever had never gotten away from an engineer when he was dropping her down or hooking up the engine. There has been no complaints or any difficulty on this road with foaming water or with leaky dry pipes or with valves becoming dry. The lowest temperature is about the freezing point, while the highest is about 106 degrees. No complaints have been made by engineers with

reference to the manually operated reverse gears. No one has been injured by the same, nor have any requests been received for the installation of power reverse gears.

CROSS-EXAMINATION

"By Mr. McLaughlin:

"Q. Your own knowledge of the operation of the reverse gear is just from your few trips when you ran the engine and the times when you rode in the engine?

"A. Yes; and I ride quite often on the locomotives.

1260 "Q. Do you know what is meant by 'steam in the cylinders'?

"A. That means steam in the cylinder on both sides of the piston which may be caused by a leaky steam valve (T. 4518–4527)."

Thomas F. Egan

DIRECT EXAMINATION

Mr. Egan gave his address as San Luis Obispo, Calif. He is master mechanic for the Pacific Coast Railway and has been connected with that road for 8 years. He has also been a fireman and engineer on this railroad. This road runs from Port San Luis to Los Olivos in the County of San Luis Obispo, to Santa Barbara, Calif. It is a hilly country, having a maximum grade on this road of 2.1 percent. This road has seven steam locomotives; five of them are the Consolidated 2–8–0 type and two of them are 10 wheelers, or 4 6 0 type. The Consolidated weigh about 64,000 pounds on drivers and the 10 wheelers 71,000 pounds on drivers. They are all reversed by hand levers. Six of them have a slide valve, Stephenson link, and one is Walscheart. None of them are superheated. The Consolidated type carry 155 pounds steam pressure, while the other two carry 180 pounds. Practically all the trains are mixed service. The tonnage on the smaller locomotives are eight 30-ton cars, and on the 10 wheelers it is 10 cars. The engine crew that goes out on the morning run spend from one-half to one hour in switching service, while the afternoon crew usually spend from an hour and a half to 2 hours in switching service. The Consolidateds have a drop seat box and the 10 wheelers have a stationary seat box. The reverse lever is located to the left of the engineer's seat box and from 8 to 12 inches ahead of him when the lever is in central position. On six of them the center of the quadrant is 12 inches from the cab floor, and on the one with the Walscheart valve gear it is about 2 feet. The top of the Johnson bar when in center position is about 4½ feet from the floor board. No complaints have ever been received on account of the Johnson bar interfering with

the engineer getting to the appliances on the boiler head. I have observed that in switching around the yard the engineers
1261 usually stand up, because they are going backwards and forwards and it is much easier to see and be on the look-out. The engineers make a daily report of any deficiencies in the mechanism of the locomotive which are made to me as master mechanic. Our locomotives have no foot braces, nor have such been requested. No reports have been received concerning any deficiencies in the operation of the hand reverse gears. At Hadley, Calif., we have an interlocker tower with the Southern Pacific. When our trains approach the Southern Pacific crossing going west the engineer gets the signal from the fireman on account of the curvature, but going east he can see the signal himself. Our trains come to a full stop before going over the crossing if the signal man don't give them the block. If he gives them the block, they whistle for the block and proceed. The reverse lever has never jumped out of the quadrant when I was operating it nor has it gotten away from me when I was hooking the engine up or dropping her down. No one on our road has been injured by the manually operated reverse gear, nor have any engineers asked for the installation of power reverse gears. Sometimes we have difficulty with foaming water in our territory. The effect of this is to carry water over into your steam slide valves and cylinders. You can tell it because it causes the engine to use an excessive amount of oil. I don't think foaming water would have any effect on the reverse lever (T. 4527–4537).

CROSS-EXAMINATION

"By Mr. McLaughlin:

"Q. With the Stephenson link motion you have a good deal more weight to lift with the lever than the one with the Walscheart motion, don't you?

"A. There is no difference insofar as handling is concerned. It depends upon the mechanical structure of the engine. Usually, if they were construcing an engine that was going to have a little more weight on it they would give a little more ratio. By that I mean leverage which amounts to making the handle longer. That is the reason why on one of them the quadrant is approximately 2 feet from the deck of the cab and the other one is down about a
1262 foot. If the locomotive foams fast enough it will take all the lubrication off the valves. A slide valve engine with the lubrication washed away from foaming would cause the handle to work more difficulty but I would say that you wouldn't have to exert yourself to any great excess amount to reverse the locomotive. The difference that would be most noticeable would be the wear on the slide valves themselves and also the cylinder packing inside of the cylinder.

"Q. Have you ever had any reports of the spring being loose or broke, or anything like that?

"A. I had a report on the valves stripping inside. They report that—that is, the spring that holds the balance part of the slide valve up, it broke, causing that position of the valve—instead of stripping they call it "to drop down" and that would make a blow on the engine. This might have some effect on the handling of the reverse lever where the engineer would notice it more than anything else is in running along at slow speed instead of having an even source, on one of them it would be blowing through all the time.

"Q. Has he ever reported a defective latch or weak spring?

"A. Yes; sometimes the latch wears down slightly. There is a bolt that goes through it and the latch itself where it fits in the quadrant will be worn down slightly and this will have to be repaired on account of the noise that it would make. We never have a broken spring. We would repair this condition because we wouldn't consider it a good mechanical fit.

"By Examiner ROGERS:

"Q. Well, why do you have a latch on there at all?

"A. To hold the reverse lever in the position that the engineer wants it. The reason we want to keep it in good condition is so that it will hold in its position.

"By Mr. MCLAUGHLIN:

"Q. And, if it is not kept up so it will hold, there is a tendency for it to work out and let the lever go to the corner; is that right?

1263 "A. If it got in a bad enough condition it would (T. 4537–4544).

SOLON F. LUZZADDER

DIRECT EXAMINATION

Witness Luzzadder gave his residence as Paxton, Calif., and has been employed by the Indian Valley Railroad four years as fireman, two years as engineer, and two years as master mechanic. This railroad is located in Plumas County, Calif., and runs from Paxton to Engel Mine, 21.8 miles. About 8 miles of this distance is level country and the other 13 miles is hilly country, having a maximum grade of 4 percent. The railroad has two steam locomotives engaged at the present time in freight service. These locomotives are the consolidated type 2–8–0, weighing 130,000 pounds on drivers, having Stephenson valve motion, the Richardson balanced D valve. They are not superheated and are equipped with hand reverse levers. The trains carry 3 loads of a capacity of 80 tons to the load or 7 empties rated at 20 tons. At the present time there is one engine crew working 3 days a week from 3 to 10 hours per day. Two days of the 3 are to Crescent Mills, which is a distance of 8 miles; and

one day a week to Engle Mine. Most of the work is done at Crescent Mills. On the 3-hour day one hour is devoted to switching service and on the 8-hour day about three hours is consumed in switching service. The engineer's seat is a drop-seat box. The reverse lever is to the left of the engineer's seat and the center of the quadrant about 6 to 8" above the floor board of the cab and the top of the reverse lever in center position is about 48" high, and there are 22 notches on the quadrant. There is ample clearance around the reverse lever in relation to the engineer's seat box and the Johnson bar does not in any way interfere with the engineer getting to the appliances on the boiler head or the brake valve. The engineer operates the re-
1264 verse lever while sitting down out on the road and operates it standing up when switching. There is one foot brace on these locomotives. It makes it more convenient to brace yourself in operating the reverse lever. The engineer has never had to have any assistance in operating the reverse lever on any locomotives of the Indian Valley Railroad. This railroad has no block signals. It crosses the new line of the Western Pacific Railroad about 300 yards below Crescent Mills, but no trains are operating over this new line as yet. This railroad crosses the county highway 8 times, but we have never had any accidents at any of those highway crossings. The temperature in this territory ranges from 10 above zero to about 101 above. We have never had any water trouble or trouble with foaming, and consequently have never had any trouble with leaky dry pipes. Since I have been connected with this road we never have had any trouble with the lever threshing backward and forward on the quadrant, the lever has never jumped out of the quadrant, nor has it gotten away from an engineer. We have never had any difficulty of any kind with the manually operated reverse gears on our locomotives, nor has anyone been injured by the manually operated reverse lever (T. 4544–4551).

W. L. White

DIRECT EXAMINATION

Witness White gave his occupation as general manager of the Yosemite Valley Railroad, having been connected with that road 11 years, and prior thereto having had about 30 years' railroading experience in mechanical, operating, traffic, and general office work. The railroad under consideration is located in Merced and Mariposa Counties, Calif. It runs from Merced to El Portal, Calif., 77.7 miles. The first 24 miles eastward from Merced is comparatively level, but the remainder of the distance is mountainous, having a maximum grade of 2 percent. This railroad has 8 steam loco-
1265 motives, and the witness has had frequent occasion to operate the same. One of the locomotives weighs 60,000 pounds; two weigh 73,000 pounds; and five weigh 120,000 pounds on drivers.

Five of these locomotives are equipped with manually operated reverse gears, and three of them weighing 120,000 pounds on drivers are equipped with power reverse gears. They are the Mogul type 2-6-0 locomotives. The locomotives that are not equipped with power reverse gears are not superheated. The three locomotives equipped with power reverse gears are superheated and are equipped with the Alco type reverse gear. Our passenger trains average about six cars with a maximum of twelve cars to the train. Our freight trains carry a maximum from 40 to 45 cars, but the average freight train is about 20 cars. The freight engineers operate six days a week, approximately 10 hours a day, 3 or 4 of which is spent in switching service. Our passenger engineers work 7 days a week, 8 to 10 hours per day, but are allowed four days out of a month off on pay. We have both day and night service for both passenger and freight trains. Two log freight trains are not scheduled, but during the logging season the logging trains are scheduled. The engineer's seat box on these locomotives is the stationary type, and the reverse lever is located to the left of the engineer's seat box. The brake valve is to the left of the engineer's seat and approximately 3′ away, but the reverse lever does not interfere with the engineer getting to the brake valve or any appliances on the boiler head. I have observed the engineers operating their locomotives and will say as a general proposition that while out on the road running the reverse lever is hooked up by the engineer while seated. In switching in a backward motion they usually stand up to operate the reverse lever. We do not have block signals on this railroad; however, there is one railroad crossing at grade with the Santa Fe at Merced. This is controlled by an interlocker, and when our trains approach that interlocker they
1266 are required to reduce the speed to a maximum of 25 miles an hour; if the board is against them, they come to a complete stop until they get a clear board before proceeding, and if the board is with them, they go over the crossing at not more than 25 miles an hour. Our railroad crosses one State highway and three county road crossings. Since I have been with the railroad there has been four grade crossing accidents, two in which vehicles were struck by trains and in the other two where trains were struck by vehicles. Where the vehicles struck the train one approached from the engineer's side, and the other from the fireman's side. We use oil for fuel, and the fireman was in his proper place on the seat box. Minor injuries were sustained by one of the drivers in one instance, but our company was not held liable for damages. One accident occurred in 1923, another in 1925, another in 1930, and the last one in 1931. Accident reports were made to the Interstate Commerce Commission in each instance. I am almost positive that in each accident case the locomotive was equipped with hand reverse levers. Our locomotives are not equipped with foot braces nor have engineers requested them. The three locomotives equipped with power reverse gears came to us so equipped when purchased in the

years 1921, 1923, and 1925, respectively. Since I have been connected with the road we have never had a reverse lever jump out of the quadrant nor have we had a manually operated reverse lever get away from the engineer. Neither has any man been injured by a manually operated reverse gear, and the same is true of the power reverse gear.

"Q. Was the safety feature given any consideration in your conclusion to purchase those power reverse gear locomotives? (Over objection of Mr. McLaughlin the witness was allowed to answer.)

"A. No consideration as to the safety factor was given at all. We considered that in our switching service and on our local freight trains that the power reverse gear was a convenience and would facilitate the switching operations. .

1267 "By Mr. MILLER:

"Q. Based upon your experience as general manager of the Yosemite Valley Railroad, and having reference to your locomotives on that road and the service in which you use those locomotives, from the standpoint of safety what have you to say as to the relative merits of the hand reverse gear and the power reverse gear?

"A. They are equal, in my opinion; there is no difference whatsoever between the two types as affects the safety of operation."

CROSS-EXAMINATION

We have found that the power reverse gear is suitable and safe in the service to which it is put (T. 4551–4562).

CHARLES J. RULISON

DIRECT EXAMINATION

Witness Rulison gave his address as Carson City, Nev., and his occupation as master mechanic of the Virginia and Truckee Railway, having been employed by that railroad for 24 years. This railroad is located in the western part of Nevada. It runs from Reno to Virginia City with a branch line from Carson City to Minden, Nev. The total mileage of the main line and branch is 68 miles. The territory is flat and mountainous, with a maximum grade of 2.25 percent. This line operates a mixed train service and has 8 steam locomotives, four of which are in service. Of those in service one is a 4–4–0, and three are 2–6–0's. The 4–4–0 engine weighs 64,000 pounds on drivers, and one of the others weighs 100,000, while the other two weigh 120,000 pounds on drivers. These locomotives are reversed with hand-operated reverse levers, having Stephenson valve motion, American balanced valve, D type, a slide valve. Our trains carry one passenger car, one mail car, and one Wells-Fargo car regularly, and in addition from a few to as high as 15 freight cars.

The crew makes a round trip every day, 7 days of the week,
1268 and it requires about 10 hours, and of this time from one-half an hour to 2½ hours will be devoted to switching service. The seat boxes on our locomotives are both wood and iron. We do not have the drop seats. The clearance between the reverse lever and the engineer's seat box is just about enough to get your feet and leg by, approximately 4 to 6″ clearance. I have found the clearance ample when I operated the locomotives. When I had occasion to operate the locomotives as a general rule in switching I would stand up to operate the Johnson bar, but if running and hooking her up for instance I could operate it sitting down. I am 69 years old and have never had to have assistance in operating the Johnson bar. We have never had to relieve an engineer on account of exertion due to operating the Johnson bar nor have we had any complaints from our engineers with reference to the manually operated reverse gears. Our engineers make out work reports of any mechanical defects and no complaints have been reported about difficulties with the manually operated reverse gears and no one has been injured by the manually operated reverse gears. We have no block signals on this line nor do we cross any other railroads. We do cross three state highways and several county highways at grade. The temperature in this territory ranges from 20 below zero to 100 above in the summer. We have had no accidents of any kind with the manually operated reverse gear.

CROSS-EXAMINATION

"Q. Do you get any reports asking you to do certain things about the manually operated reverse?

"A. Very seldom, except it might be natural wear on the quadrant and reverse gear, once a year maybe.

"Q. What would happen if it was allowed to be used in a worn condition?

"A. If the pins got very badly worn, and you wanted to throw the lever over to the left and lifted the hand latch to
1269 lift the reverse-lever latch, it might not lift quite high enough. You might have a little trouble getting it up if you let your pins wear too much.

"Q. If your latch spring was weak and would not engage the dog in the quadrant when you released it, do you think that would be a dangerous condition of the lever?

"A. It might give an opportunity for the latch to fly out, which would be very improbable, because it drops down by gravity and fits in the latch, but if the latch is in such a condition that it will fly out, that might be a dangerous condition because the lever might fly down in the lower section of the quadrant.

"Q. And if you were handling the lever when it flew that way or anywhere near the lower section of the quadrant, would it go down with enough force to injure you?

"A. That would depend on how hard your engine was working. If the engine was working hard and the latch would fly out, I would consider that a dangerous condition.

"Q. How about cold weather, when you get these low temperatures and your lubrication stiffens up; does that make a difference in the handling of the lever?

"A. I do not think so, because the steam heats the oil anyway, and lubrication will be about the same in the summer as in the winter; the temperature would be the same in the cylinders.

"Q. I am talking about the links; the cold weather would make the lubrication stiffen up, wouldn't it?

"A. It might, possibly; it all depends on the quality of oil you use; we use two different kinds of oil, one for summer and one for winter."

Of late years I have run an engine about once a month, and I have never had to operate the reverse lever when the valves were getting dry. I kept the lubricator going so I would have well-lubricated valves (T. 4562–4572).

1270 J. A. McNABB

DIRECT EXAMINATION

Witness McNabb stated that he was superintendent of the Cowlitz, Chehalis & Cascade Railway and has been so engaged for the past four years. This railroad is located in Lewis County, Washington and is 32 miles long, running from Chehalis to Cowlitz. The first 15 miles is level and the balance is hilly, having a maximum grade of 1.5 percent. This road handles freight service only at the present time. The road has two steam locomotives, one is a 2–6–0 type weighing 139,000 pounds on drivers, and the other is a 2–8–2 weighing 142,000 pounds on drivers. These locomotives are equipped with manually reversed levers. The 2–8–2 has a Walscheart motion and the 2–6–0 a Stephenson. The Walscheart is a piston valve while the Stephenson is a slide valve. The 2–8–2 is superheated. Only one engine crew is employed at the present time. About an average of two cars a day are handled, but in normal times the trains handle as many as 30 or 35 cars. In normal times the engine crew is on duty about 10 hours a day, four hours of which is spent in preliminary and industrial switching. At the present time the engine crew are on duty about four hours per day with 30 to 45 minutes spent in switching service. These locomotives have stationary seat boxes and there is about 12″ clearance between the reverse lever and the engineer's seat box. I operate these locomotives occasionally and have found the clearance between the reverse lever and the seat box ample. On these locomotives the center of the quadrant is from 18″ to 2′ above the running board of the cab, and the top of the Johnson bar is from 4½′ to 5′ from the floor board when the Johnson bar is in the center position on the quadrant. We have had no complaints

from engineers with reference to the Johnson bar interfering with their getting to any appliances on the boiler head. I have observed
1271 the engineers operating their locomotives from time to time and find that out on the road they operate the Johnson bar sitting down, but as a general rule in switching the engineers stand up. Both locomotives are equipped with small foot braces at the forward end of the quadrant. None of our engineers have had to have assistance in operating the manual reverse gear. Our railroad does not have block signals. We cross one other railroad, which is protected by stop boards and our trains have to come to a full stop before proceeding over that railroad crossing. Our railroad crosses two State highways, 17 county highways, and 5 street crossings, and we have not had any crossing accidents since I have been superintendent. The Johnson bar has never gotten away from our engineers, it has never jumped out of the quadrant or has never broken, nor has anyone been injured in any way with the Johnson bar or any part of the reverse gear since I have been superintendent. In our territory we have had no difficulty with foaming water, leaky dry pipes, or with the valves becoming dry. We have had no complaints from our engineers in relation to the operation of the manually operated reverse gears, nor have we had to relieve any of them from duty on account of physical exertion caused by operating the manually reversed gears, nor have any of the engineers asked for the installation of power reverse gears.

CROSS-EXAMINATION

If the engineers have any dry valves it is their duty to report the same to me.

"By Mr. McLAUGHLIN:

"Q. Do you look for dry valves to occur very frequently on an engine that has just been overhauled?

"A. Yes; there is a chance for a stoppage of the lubricator pipes where they are all taken off. Dry valves will make the reverse lever work harder.

1272 "Q. And your testimony is that if an engine is overhauled and has gone through the shop it doesn't stiffen up the mechanism of the reverse gear so that it handles any differently than before?

"A. It doesn't handle any harder if it is properly overhauled and lubricated (T. 4572–4582)."

H. J. NICHOLLS

DIRECT EXAMINATION

Witness Nicholls appears for the Sierra Railway Company which is road no. 200 on sheet 19, exhibit 41. This witness gave his ad-

dress at Tuolumne, Calif., having been an engineer for the above-named railway for 9 years and previous to that having been a fireman for six years. This road runs in Stanislaus, Tuolumne, and Calaveras Counties, Calif. The main line runs from Oakdale to Tuolumne with a branch from Jamestown to Angels Camp, 57 miles of main line; and 19 miles of branch. The territory is mostly hilly having a maximum grade of between 2 and 3 percent. This road renders both freight and passenger service. Locomotive no. 18 is the 2–8–0 type weighing 104,000 pounds on drivers. It is used in freight service, is hand reversed and superheated, and generally known as the "deckless-type engine." Engine nos. 20 and 22 are the same type as no. 18. Engine no. 24 is a 2–8–0 type weighing 144,000 pounds on drivers. It is used in freight service and is hand reversed but not superheated—it is saturated. No. 28 is a 2–8–0 type weighing 110,000 pounds on drivers. It is used in freight service and hand reversed. Engine nos. 30 and 32 are 2–6–2, prairie type, weighing 80,000 pounds on drivers, and used in both freight and passenger service. Engine no. 34 is the 2–8–2 type weighing 134,000 pounds on drivers, used in freight service, and hand reversed. Engine no. 36 is a 2–8–2 type weighing 170,000 pounds on drivers, used in freight service and is power reversed by air. Engine no. 3 1273 is a 4–6–0 type weighing 60,000 pounds on drivers and used in passenger service. Nos. 18 and 3 have Stephenson-link valve motion, and all the other 8 have Walscheart valve motion. The passenger trains carry two to three cars, the freight trains at the present time average about 25 cars, but formerly when business was better hauled about 60 cars. Our freight engineers work from 8 to 10 hours six days a week, and about 3 hours of this time daily is spent in switching. The deckless engines have drop seats while the other engines have stationary seats. The reverse levers on the deckless engines are located right at the side of the seat. On the other locomotives they are on the left and to the front of the engineer. There is ample clearance between the engineer's seat box and the reverse lever and the manual reverse lever does not in any way interfere with the engineer getting to any of the appliances on the boiler head. These locomotives are equipped with foot braces but I never have to use them in reversing the engine and have always been able to operate the hand reverse without assistance. I operate the hand reverse either sitting down or standing up but usually stand up in switching service. Our railroad crosses the Santa Fe at grade and is protected by a board. Our trains have to come to a full stop before proceeding over the crossing. Our road crosses one state highway on the main line and one on the branch. We also cross a number of county roads. I am able to keep a lookout ahead to observe all these crossings, and operate the reverse lever in either hooking up the engine or dropping her down. In back-up switching movement I have experienced no difficulty in

getting signals from the man on the ground and operating the hand reverse lever at the same time. During my experience with this road the hand reverse lever has never threshed backward and forward on the quadrant or gotten away from me or jumped out of the quadrant. The temperature in this territory ranges from
1274 freezing to 110 above. We have experienced no difficulty with foaming water or with leaky, dry pipes, and consequently have had no difficulty with the valves becoming dry. I have had no difficulty in clearing the cylinders of steam, however, if there are men on the ground near the locomotives they should be notified to keep away from the cylinder cocks before clearing the cylinders of steam. I have had no crossing accidents since I have been an engineer on this road. I have always been able to perform my other duties as engineer and still operate the hand reverse lever, and have never had to be relieved from duty due to exertion caused by a manually operated reverse gear. No one to my knowledge has been injured with a Johnson bar. We have never had any difficulty with either the manually operated reverse gear or with the power reverse gear on our locomotives (T. 4582–4592).

CROSS-EXAMINATION

The lubricator is up on top, back of the boiler. The brake valve is up over the reverse lever. When the reverse lever is in center position it is about 3′ high, and I can reach right around the lever when I want to get to the brake valve. The lubricator is about 2½′ away from the seat box and can be easily seen with the eye.

"By Mr. McLAUGHLIN:

"Q. Do you mean you can keep your eye on the man on the ground and at the same time throw over the lever when you are sitting looking back toward the tank, and you have got your head and shoulders out of the cab window?

"A. Yes; you can reach down and grab it any way you want to—it is right there by your side. You do not have to change your position to come in and get the lever and throw it over when you are making a switching movement.

"Q. Under what circumstances do you open the cylinder cocks to relieve steam? What are you doing when you find yourself with steam in the cylinders?

1275 "A. Sometimes when you reverse, on account of the slide valve engines, you have more pressure on your valves and you have got to release some pressure in your cylinders, as it would handle too hard if you would not relieve the steam out of the cylinders. There may be sometimes when you could hardly handle the lever if you left the steam in the cylinders (T. 4592–4599).

CHARLES B. SEXTON

DIRECT EXAMINATION

Witness Sexton stated that he was general manager of the Eureka Nevada Railway Company and has been engaged with that railroad for about 9 years. This is a narrow-gage line running from Palisade to Eureka, in Eureka County, Nev. It connects with the Southern Pacific and Western Pacific at Palisade. This road performs passenger and freight service, and trains operated by a steam locomotive have made 22 round trips from January 1 to May 31, 1931. A trainload consists of about 50 tons of silver-lead ore. This road has paid no dividends for six years. It is located almost entirely in desert country, with the exception of the first fifteen miles, which is rather good coal country, but on account of its being so close to the main line no revenue is received from this coal. About half-way over the line we get some sheep and a few cattle every year; otherwise there is nothing picked up en route. The financial condition of the road is not very good. We have been unable to spend money on improvements. Recently the Southern Pacific gave us 1,500 large ties taken out of their main line and have promised us about 2,500 more. Unless business picks up the road may have to close down. We run motor cars to save expense. If there is a shipment of 6,000 pounds of flour, we will take part of it one day and other portions on following days to save running a steam train. We have a 7-mile 2-percent grade coming down to Palisade. Our problem is to get busi-
1276 ness, and we often split up shipments with the view of running as few trains as possible. We have three locomotives, two of them are consolidated, 14×18 cylinders, of the 2–8–0 type, one weighing 55,000 pounds on drivers and the other 59,000 pounds; one is a 2–6–0 type, weighing 34,000 pounds on drivers. The fire box on one of the consolidated engines is 78″ long and on the other 78¾″ long. On the smaller engine it is 42″ long. The two larger engines have steam pressure of 160 pounds, while the smaller one has 107 pounds. The temperature in our territory ranges from 25 below zero to 110 [illegible] nected with this road due to failure to keep a proper lookout or any other cause. Our railroad runs north and south. The travel from Nevada is east and west. Since the completion of the Lincoln Highway, travel goes mostly by stage. Our passenger trade used to be 15,000 persons annually—last year it was 1,500. For instance, travel toward Reno in the west, the stage goes on one leg of the triangle, while we have two; and if we carry a passenger free to the main line the passenger still has as far to go on the main line to get to Reno, and the fare is about the same. As a consequence, we have practically no passenger revenue. In 1926 our railway operating revenue was $130,007. I have here a statement showing the net railway operating income or deficit for the past five years. The fig-

ures are taken from the annual reports to the Interstate Commerce Commission. The statement was received in evidence marked "Defendant's Exhibit No. 42, Witness Sexton." I have here a statement showing locomotive-miles on the Eureka Nevada Railroad for the years 1926 to 1930, inclusive. They were prepared by myself and signed by me, and were submitted to and taken from the Interstate Commerce Commission annual reports. The statement was received in evidence as "Defendant's Exhibit No. 43, Witness Sexton."

1277 I have here a statement showing the number of locomotives in service. It was made by me from authentic reports and from the locomotive inspection reports. It gives the weight on the drivers, length of fire box, steam pressure, and size of cylinders, and is in the short-line reports to the Interstate Commerce Commission. The statement was received in evidence as "Defendant's Exhibit No. 44, Witness Sexton." I have another statement showing the tons of revenue freight and the number of passengers carried for five years made from original records by miles. The statement was received in evidence as "Defendant's Exhibit No. 45, Witness Sexton." I would like to make a further statement for the record as requested by the general manager of the Nevada Central, which is a shortline paralleling our road, 50 miles further west.

"By Examiner ROGERS:

"Q. Do you have personal knowledge of the facts which you will relate?

"A. I have of the operating conditions. They are similar, through similar territory and about the same number of trains are run. The Nevada Central is a narrow-gage road, 92 miles long, running from Battle Mountain on the Southern Pacific to Austin on the Lincoln Highway. This road runs north and south in Lander County. They have motor cars and I believe run fewer trains than our road. Traffic conditions on the Nevada Central are a trifle worse because Eureka has had mining, and there are some old mines on our road that may pick up. The Nevada Central has two locomotives. No. 2 is a 2–6–0 weighing 37,000 pounds on drivers, No. 5 is a 2–4–0 weighing 27,000 pounds on drivers (T. 4599–4612)."

Washington, D.C., September 22, 1931

ARTHUR L. BURNS

DIRECT EXAMINATION

Witness Burns appears for the Ligonier Valley Railroad Company, which is no. 122 on exhibit 41. He stated that he lived at Ligonier, Pa., and was a fireman on the Ligonier Valley

1278 Railroad which runs from Ligonier to Latrobe, which has a main line of about 10 miles and 7 miles of branch. It is on a river grade having no bad curves and a maximum grade of about 3 percent. The passenger service is performed by a gasoline motor.

This road hauls coal and coke and it is all practically switching and yard work. Locomotive No. 17 is out of service, while nos. 12, 15, 18, and 19 are in service. Nos. 12 and 15 weigh 157,000 pounds on drivers and have air-operated reverse gears. Nos. 18 and 19 weigh 159,000 pounds on drivers but are equipped with hand reverse gears or the old Johnson bar. Those four locomotives have 200 pounds of steam pressure but are not superheated. They are equipped with Walscheart valve motion, slide valves. At the present time the freight trains carry from 25 to 30 cars but when business is normal the trains carry 50 cars. At the present time we are only using one locomotive which operates on an average of about 10 hours per day, six days a week. Locomotives Nos. 18 and 19 have drop seats and the reverse lever is located right in front of the engineer. There is ample clearance between the reverse lever and the engineer's seat box. The center of the quadrant is about 14 or 15" high from the running board of the cab. When the Johnson bar is in center position on the quadrant the top of it is about 3½' from the floor board. The Johnson bar does not prevent the engineer from getting to any of the appliances on the boiler head. The Johnson bar may be operated or reversed while either sitting down or standing up. Engines Nos. 18 and 19 have foot braces but it is unnecessary to brace yourself in operating the hand reverse lever on these locomotives. Our railroad crosses the Lincoln Highway twice on the Wye in the yard and we also cross some country roads. There is no difficulty in observing these crossings and in reversing the locomotive.

1279 About half the switching service is a back-up movement. In backing up the engineer sometimes sits on the seat box, but more frequently stands. I have never observed the Johnson bar thresh up and down on the quadrant nor get away from the engineer. In our territory we have no trouble with foaming water, leaky dry pipes or dry valves and no one has been injured by a manually operated reverse gear. No engineer has had to be relieved from duty on account of exertion due to operating the Johnson bar and the locomotive now in service runs between 50 and 60 miles per day. On locomotives Nos. 12 and 15, equipped with air reverse gears, there has been no difficulty with that type of gear.

CROSS-EXAMINATION

We have four serviceable locomotives and as only one is required we can shift them around when it is necessary for one of the locomotives to be repaired. On the road we hook them up fairly well between stations and we can hook the power reverse gear up where we want it. It is operated by a small short lever in the cab. Outside of the cab there is a cylinder in which a piston operates. At each point where there is much switching to be done it generally requires a good many movements of the reverse lever. It requires more strength to handle the reverse lever when there is steam in the cylinders. The notches on the quadrant or the dog in the latch have

not been worn from long useage. The average coal consumption as nearly as I can tell is about 4 or 5 tons per day.

"Examiner ROGERS. We have had so many discrepancies between the testimony of the witnesses and what is shown on the exhibits that I am beginning to feel a little leery about the exhibits; as I get it on sheet 14 the coal consumption is given at 2,500 pounds per day, on the average.

"Mr. MILLER. That is the figure which was furnished me (T. 4612 to 4625)."

1280 J. W. CHADWICK

DIRECT EXAMINATION

Witness Chadwick appears for the Augusta Northern Railway, no. 18 on exhibit 41. He gave his address as Saluda, S.C., and is employed as general manager of the Augusta Northern, having served in that capacity for about 20 years. This line runs from Saluda to Ward, S.C., 12.2 miles. It has a gasoline motor bus to carry passengers, express, and mail. One steam locomotive performs the freight service. It is a 2–8–0 type, weighing 108,000 pounds on drivers, and is reversed by a manual lever or Johnson bar, and has sliding valves. The locomotive is run from 3 to 4 hours a day six days a week, under present conditions, but when business is normal it takes 5 or 6 hours per day. Our road crosses one State highway at Ward, which is located at the intersection of the Southern Railway's private siding and our tracks. We stop at this place before reaching the crossing in order to give the head brakeman an opportunity to throw the switch so that the train can enter the proper track. This locomotive has the drop seat, and the reverse lever is located to the left and a little bit in front of the engineer. At the end of each run the engineer makes a report of any defect or any accidents or any repairs that are needed to the locomotive. This report is made to me, and the engineer has standing instructions to see himself that those repairs are made immediately. Repairs are usually made very promptly. Over objection of Mr. McLaughlin the witness stated that no reports were ever made about the reverse lever jumping out of the quadrant. The witness stated that he knew of no instances where the reverse lever has gotten away from the engineer in hooking up the engine or dropping her down or reversing the engine. No one has been injured by the manually operated reverse gears. We have good water in our territory and are not troubled with foaming water, and
1281 we have had no difficulty with valves becoming dry. When the locomotive operates about three to four hours a day, about one-third of that time is consumed in switching. When there is more business and the locomotive works six hours per day, about two hours of that time would be spent in switching. We have never received any complaints from the engineer with reference to having

to operate the engine with a hand reverse gear, and we have never had to relieve the engineer from duty on account of exertion due to handling a manually operated gear, and we have never been asked to install power reverse gears.

CROSS-EXAMINATION

"By Examiner ROGERS:

"Q. What did they do to the reach rod?

"A. When one of our locomotives needed repairs we sent it to the Southern Railway, and they gave the locomotive a general overhauling. If there is anything worn the least bit or so that it will not give proper service or does not work satisfactorily or is not entirely safe, they usually either put in a new piece or repair that part. This locomotive was brought back from the Columbia, S.C., shops to Ward in tow. The engineer examined the work that had been done at the shops, and he discovered that the reach rod jammed a little bit and worked tight."

"By Examiner ROGERS:

"Q. Do you know where it was tight?

"A. Yes; the reach rod rubbed the wheel. That I think was caused by its being too thick. Our engineer inspected it and said: 'This is a little bit too tight. We will have to have it changed.' The reach rod which the Southern Railway put in was too thick,
and it rubbed against the wheel so the Southern sent a me-
1282 chanic down there to have it changed. After this reach rod
was attended to the second time we never had any trouble with it. My recollection is that the particular reach rod that the engineer found unsatisfactory was located between the driving wheels and the frame, and it was a little bit too thick. Consequently, the engineer asked to have it changed before he used the engine. We have to have our locomotives overhauled in an outside shop. I could not tell definitely whether or not they have made repairs on the reverse gear at other times."

By Mr. MCLAUGHLIN:

"Q. When was this occasion about the engine repair in the Southern shops?

"A. It has been a long time ago. I do not recall exactly when it was. I think the number of that engine was no. 7. We are not using it at all (T. 4625–4639).

F. G. HAMBLEN

DIRECT EXAMINATION

Witness Hamblen appears for the Greenville and Northern Railroad, no. 88 on exhibit 41. He testified that he was a resident of Greenville, S.C., and general manager of the Greenville & Northern.

This road runs northwestwardly from Greenville to River Falls, about 23 miles. It operates for freight and express service only. Two steam locomotives are owned, nos. 5 and 15, each weighing 136,000 pounds on drivers. No. 5 is reversed by a power reverse gear and no. 15 is reversed by a Johnson bar or by hand. These locomotives are exchanged between the runs, one locomotive will make 30 miles per day and the other will make 38 miles. The next day they may be reversed. Locomotive no. 12 which appears on exhibit no. 41 weighed 136,000 pounds on the drivers, however, that locomotive has been disposed of since the questionnaire was sent in and we have since bought no. 15 from the Tennessee, Alabama, and Georgia. These locomotives run approximately 10 hours a
1283 day for six days of the week and about 3 hours of that time is spent in switching service. Our engineers are instructed and they do make a report at the end of each of their runs every day as to the mechanical conditions of their locomotives. Those reports are made to me and I inspect the same. We have never had any complaints from our engineers about the Johnson bar jumping out of the quadrant or getting away from the engineers at any time. The senior engineer has made the trips with me to the shops each time the engines have been repaired and the request to put a power reverse gear on no. 5 is the only one I have ever had. Our locomotive no. 15 was overhauled since no. 5 was and this same engineer made the trip to Atlanta with me and he made no request or said anything about a power reverse gear being placed on no. 15. Whenever small repairs are made the work is done at the shops of the Southern Railway in Greenville. Since the power reverse gear was installed on no. 5 I recall one repair bill as having been received from the Southern Railway on which was an item for repairs to the power reverse gear. The power reverse gear has been on this locomotive about 18 months. No one has been injured on our road due to handling either the power reverse gear or the hand reverse gear.

CROSS-EXAMINATION

The master mechanic for the Southern Railway interceded for our engineer to have this one locomotive equipped with a power reverse gear. No complaint was made by him in regard to the handling of the manual reverse. The Also type was installed and it cost $225.00 f.o.b. factory. I do not know the cost of installation because the bill for repairs received from the Southern Railway was not itemized to that extent. The locomotive was sent in for general repairs, the bill rendered covered the material and labor for general overhauling of that locomotive and did not specify in what particular part of the locomotive it was used. Our engineers have not made
1284 any complaint about the manual reverse gear or about the valve motion or about valves becoming dry.

By Examiner Rogers:

"Q. You said they had one repair bill from the Southern at Greenville on the power reverse?

"A. The way they render their bill is that they put so many hours at so much and they show the work they did. One item on that work was on the power reverse but the amount of money was not split up between the different items of repair. I am satisfied with the power reverse which was put on this locomotive and I believe the engineer is too, because he has never made any complaint about it (T. 4639–4649)."

J. A. Monahan

DIRECT EXAMINATION

Witness Monahan appears for the Narragansett Pier Railroad Company, no. 152 on exhibit no. 41. The witness gave his address as Wakefield, R.I., and his occupation as Superintendent of the Narragansett Pier Railroad Company, having been connected with that railroad in various capacities for over 21 years. This road connects with the New York, New Haven & Hartford Railroad at Kingston and runs to Narragansett Pier, R.I., a distance of 8⅓ miles. It has two locomotives, one is a 2–6–0, and the other is a 4–4–0. Both are reversed by hand levers. There is seldom any freight at Narragansett Pier and the crew comes north to Wakefield. It takes them about a half an hour to do the switching there and then to proceed to Peacedale, R.I., where a little switching is done. Then they go on to Kingston and wait until the freights in both directions on the New Haven railroad have arrived. After the freights arrive our crew picks up their cars and go down the line dropping the freight cars at the various stations. The engine crew is on duty about 11 hours, but the actual running time is only about 4 hours. About two hours of each day is spent in switching service.

1285

The engineer's seat is what is known as a stationary seat box with a cushion on it. The reverse lever is located just to his left. If there are any defects in the locomotive there is a book in the engine house which the engineer is required to use in making a report on defects. Our engineers have never complained about the clearance between the seat box and the reverse lever. They have made no complaints about the Johnson bar interfering with their being able to get to appliances on the boiler head. I have observed the engineers in the operation of their locomotives and have seen them work the Johnson bar both sitting down and standing up. We cross one state highway three times and we have crossing men as a protection at each one of those places. We cross two town highway crossings which are protected by automatic bells and there are some other crossings which have no protection at all. The kind of work report which we have, I believe, is known as the I.C.C. form M–60. The

master mechanic consults this book to learn about defects that are reported and he has the work done and signs the book or report that the work has been done. We have received no complaints from the locomotive engineers as to the operation of the reverse gear on our locomotives.

CROSS-EXAMINATION

"By Mr. McLAUGHLIN:

"Q. You did not make any particular point of going out on those road trips to observe the reverse gear? You were just riding along?

"A. That is true (T. 4649–4656)."

C. J. MAYE

DIRECT EXAMINATION

Witness Maye appears for the Lake Champlain & Moriah Railroad Company, no. 112, on exhibit 41. The witness gave his address
1286 as Port Henry, N.Y., and his present occupation as superintendent of the Lake Champlain & Moriah Railroad. This road is located at the northern end of New York and runs from Port Henry, N.Y., to Mineville, 6.62 miles. It owns four steam locomotives, two are the consolidated type and two are the Santa Fe type. All are hand reversed, having sliding valve motion, and are the Walscheart make At the present time only one locomotive is operated. Under normal business conditions two are operated at a time. The engine crews work about 8 hours per day, and under normal conditions about half of that time would be spent in switching service. These locomotives are equipped with the stationary type of seat boxes. No complaints have been received from engineers with reference to the clearance between the seat boxes and the reverse levers, nor have they complained with reference to the Johnson bar interfering with their getting to appliances on the boiler head. I have frequently observed engineers in the operation of their locomotives out on the road and in running on the road they usually sit down while operating the Johnson bar; however, in the back-up switching movement they usually stand up. We have had no complaints from our engineers with reference to the amount of strength necessary to operate the hand reverse lever, nor have we had to relieve an engineer from duty to do exertion in operating the same. We have had no complaints from engineers about the Johnson bar jumping out of the quadrant or getting away from the engineers. No one on our road has ever been injured, as far as my knowledge goes, by the manually operated reverse lever. Our engineers have never requested us to install power reverse gears. We cross some county highways at grade. Our road has no block signals or order boards.

CROSS-EXAMINATION

"By Mr. McLaughlin:

"Q. Have you ever instructed your engineers to report the fact to you if the reverse lever gets away and goes down in the corner?

1287 "A. Yes, if anything happens to the engine whatsoever, to the detriment to the running of it, or otherwise, they are to report the same to the master mechanic at the first opportunity. The engineer has to make his own record in the book at the shop. I have examined that and have observed the records as showing such as a brake shoe loose or brake hanging.

"Q. Did your engineers ever request you not to put the power reverse on your engines? What conversation did you have about it?

"A. When this order came up I asked them if they knew anything about a power reverse gear and they were not familiar with it at all in the first place, therefore, they could not answer it intelligently whether they would like power reverse gears or not (T. 4656–4663)."

A. D. Fowlkes

DIRECT EXAMINATION

Witness Fowlkes appears for the East Carolina Railway, no. 61 on exhibit 41. The witness gave his address as Tarboro, N.C., and his occupation as superintendent of the East Carolina Railway, having been connected with that road for about 22 years. This line is 100 miles south of Norfolk and extends from Tarboro, N.C., to Hookerton, N.C., 39 miles. This road renders local freight service and owns three steam locomotives. They are the 4–6–0 type weighing approximately 107,000 pounds on drivers. Two of these locomotives are hand reversed, one has a Richardson valve motion and the other has the Walscheart, and both have slide valves. One locomotive is equipped with the Lewis power reverse gear. This latter locomotive was bought second-hand from the R. F. & P. and was equipped with power reverse when purchased. None of these locomotives are superheated. One of these locomotives is operated each day varying from 7 to 11 hours. About 3 hours of this time is consumed in switching service. I have had occasion to ride on

1288 these locomotives and observe the engineer in the operation of the same. These locomotives have what is known as the drop side seat and there is ample clearance between the engineer's seat and the reverse lever. Running between stations the engineer usually sits down, but in switching service he usually stands up. These locomotives are not equipped with foot braces nor have we been requested to put in such braces. Our engineers have never had to have assistance in operating the Johnson bar nor have they com-

plained of exertion because of the strength necessary to operate the Johnson bar. We have no block signals or order boards on our line. This railroad crosses four state highway crossings, and after whistling on approaching such crossings the engineer slows down his train. Of the 3 hours spent in switching service each day I would estimate that about one-third of the time is used in back-up switching service. If anything is mechanically wrong with the locomotive it is the duty of the engineer to report same to the master mechanic, whose duty it is in turn to make the necessary repairs and file a report with the repairs made to me. The engineer is required to make a report at the end of each run whether anything is wrong or not. Over objection of Mr. McLaughlin the witness was allowed to state that as far as his knowledge goes the Johnson bar had never jumped out of the quadrant or gotten away from any of the engineers. No one on our road has been injured by a manually operated reverse gear, and we have had no complaints with reference to the hand reverse gears. We have had some complaints about the power reverse gears from the engineer who said it gets out of order and sticks on him. No one has been injured on our road by a power reverse gear and our engineers have not requested that the hand reversed engines be equipped with power reverse gears.

CROSS-EXAMINATION

Our engineers have never asked us to equip their engines with any kind of mechanical device. The only time I ever
1289 observed an engineer step across the quadrant was to get down on the deck for the purpose of getting a drink of water or getting off the locomotive.

"Q. You found reports for work to be done on the manual reverse gear as well as the power reverse gear?

"A. I do not recall having seen the reverse gear mentioned, except the power reverse gear. However, we do overhaul the manual reverse gear at times because those parts wear out like everything else.

"Q. The nature of those reports concerning the power reverse is simply to oil the parts or remove the packing, or something like that?

"A. I do not know what the master mechanic has to do. The engineer reported it out of order.

"Q. You have work reports about the pump or other operating mechanism on your engines, don't you?

"A. Yes; I am sure we do.

"Q. You haven't had any requests from your engineers to take off the power reverse, have you?

"A. No (T. 4663–4673)."

R. F. Thomas

DIRECT EXAMINATION

Witness Thomas appears for the Townsville Railroad Company, no. 218 on exhibit 41. The witness stated that he was an engineer on the Townsville Railroad Company and resided at Townsville, N.C. He has had a little over three years experience as an engineer on that railroad and 18 or 20 years prior experience as a railroad engineer on other railroads. This road runs from Townsville to Drury and then to Manson, 10.5 miles. It performs no passenger service. One Consolidated 4–6–0 type locomotive is owned. It has Stephenson-link motion and slide valve and is reversed by hand.

The round trip requires about 4 hours and about 30 minutes
1290 of that time is consumed in switching. Trains run only 3 days a week. The locomotive is equipped with a stationary seat box having a cushion on it. The Johnson bar does not prevent the engineer from getting to any of the appliances on the boiler head. The Johnson bar does not thresh back and forth on the quadrant, has never gotten away from the engineer and there has never been any difficulty in operating the same. These locomotives have no foot braces. I have never been injured by the manually operated reverse gear, nor has anyone that I know of been so injured. I can operate the Johnson bar sitting down and can keep a lookout ahead for crossings while operating the hand reverse lever. I have never operated a power reverse engine.

C. H. Pruder

DIRECT EXAMINATION

Witness Pruder appeared for the Carolina Southern Railway, no. 37 on exhibit 41, and gave his address as Windsor, N.C., and his occupation as superintendent of that railway. He has been connected with this road for around 29 years, about 19 of which he was a locomotive engineer. This road performs freight service, carrying from 5 to 10 cars to a train, and runs from Ahoskie to Windsor, 22 miles. Two locomotives are owned, both hand reversed. One has the outside valve gear, Walscheart, and the other one has the Stephenson link gear. Neither locomotive is superheated. The locomotive crew is on duty about 5 hours per day, 30 minutes of which time is spent in switching service. They run on an average of about 4 days per week. The locomotives have a drop seat, and there is ample clearance between the reverse lever and the engineer's seat box. The Johnson bar does not interfere with the engineer getting to appliances on the boiler head.

"By Examiner ROGERS:

"I never understood that the previous testimony was to the effect that the Johnson bar prevented the engineer from getting to the boiler head. What I understood was that in order to get to
1291 the appliances on the boiler head the engineer had to get some part of his hand or arms or his body in front of the reverse gear."

"By Mr. MILLER:

"That may be correct—the language used was that it interfered, as I recall it—the Johnson bar interfered with the engineer getting to the appliances on the boiler head.

These locomotives are not equipped with foot braces, and our engineers have not asked for their installation. I have never had any difficulty of any kind in operating the Johnson bar or hand reverse levers on these locomotives and have never had to ask for any assistance of any kind. I have never been injured by a hand reverse gear nor has anybody else on our road been so injured to my knowledge. Our railroad crosses two State highways, and our trains cross those highways at a speed of about four or five miles per hour. We cross a great number of country roads but have never had any accidents at one of those crossings. In the switching movements I would estimate that only about 10 minutes of it was back-up switching. I, myself, have never had any complaints to make with reference to having to reverse these locomotives by hand, nor have I heard complaints from other engineers.

CROSS-EXAMINATION

"By Mr. MCLAUGHLIN:

"Q. What are some of the conditions that you found that caused the hand reverse lever to work harder?

"A. When steam gets in the cylinder ahead of the piston or when the valves are getting dry, also when the counter-balance spring gets out of adjustment or is not properly lubricated. You can release that steam by pushing your foot on the cylinder cocks, releasing the whole works (T. 4673–4683)."

1292 Washington, D.C., September 23, 1931

DIRECT EXAMINATION

L. W. POTTER, witness on behalf of defendants, testified:

My residence is Belfast, Maine. I have been employed by the Belfast & Moosehead Lake Railroad for six years; three years and 3 months as master mechanic; for the past two years and 7 months as

an engineer. My prior railroad experience has consisted of six years firing on the Fitchburg Railroad, now the Boston & Maine; four years running on the Central Moosehead Lake & Vermont and six years as traveling engineer for the American Locomotive Company. The entire time was spent handling engines. My engineering service has been both freight and passenger. The Belfast & Moosehead Lake Railroad has both freight and passenger service. The Belfast & Moosehead Lake Railroad, located between Belfast, Maine, and Burnham Junction, is thirty-three miles; I do not know its maximum grade nor its maximum curvature. I am at present engaged in passenger service, having served the same road as freight engineer. The road has three steam locomotives. The class of locomotives used in passenger service is 4–4–0. That locomotive weighs 64,800 pounds on its drivers. In freight service we use 4–6–0 locomotives. We have two locomotives used in freight service, and they weigh 111,800 pounds on the drivers. These locomotives are reversed by hand, and they have the Stephenson slide valve motion. At present, as a rule, our freight trains haul about 8 or 10 cars; when business is good we haul from 18 to 25. Our passenger trains haul one coach and one baggage car. As locomotive engineer I am on duty nine hours per day. When running in freight service about three hours of that time would be consumed in switching. That running is done in the daytime. Freight engines are operated six days a week; passenger engines, six.

1293 Locomotive engineers on the Belfast & Moosehead Lake Railroad report thirty minutes prior to leaving time, during which time, they oil up the engine and check it over to see it is in good condition. Our locomotives have stationary seat boxes and clearances around the reverse lever and with relation to the engineer's seat box are all good. During my time of operation of those locomotives I have never had any difficulty with the reverse lever or the Johnson bar; it has never gotten away from me and jumped out of the quadrant. When operating the Johnson bar, in reversing the locomotive or hooking it up or letting her down, I sit down the entire time. In the freight switching service I perform, about half of it is in backup switch movement, during which time I sit astride the reverse lever with back out of the window so I can see in both directions. Occupying this position, I can operate the reverse lever without difficulty. I can operate the reverse lever and at the same time keep a lookout ahead for crossings or signals. There are 33 highway crossings on our road, three of which are State highways. Passenger trains approach these crossings about six miles an hour; freight trains, from two to four miles per hour.

I have never been injured by the operation of a manually operated reverse gear, nor relieved from duty due to exertion account of such operation. On our road we are disciplined for difficulties with dry valves. I do not have trouble with foaming water; nor leaky dry

pipes. The operating department of our road has a book or rules. (Rule book of the Belfast & Moosehead Lake Railroad Company, containing rules and regulations governing performance of locomotive engineers, is identified and offered in evidence, marked "Defendants' Exhibit No. 46, Witness Potter.")

I have been involved in two crossing accidents while serving as an engineer for the Belfast & Moosehead Lake Railroad; one occurred at Rolerson crossing and the other at Burnham Junction crossing.

1294 The Burnham accident happened as follows: As I came around the left-hand turn at Burnham, the fireman gave the stop signal, saying an automobile truck was coming. We stopped before we crossed the crossing; the truck came down and stopped and the fireman signaled to go ahead. As I started the truck came down, catching the left cylinder and tipping him over. The driver of the truck admitted he got mixed up and stepped on the gas.

At the Rolerson crossing accident, which occurred in the spring of the year, a boy drove onto the crossing in order to get out of the mud and in trying to turn around, he got the forward wheel of his car over the crossing plant between the guard rail and main rail, got caught and could not get loose. We came out of a ledge cut on the left-hand turn and the fireman gave the stop signal. I went down and just hit the car hard enough to knock it off the track. The engine stopped by the car. Those were the only accidents in which I have been involved and I have run all three of the road's locomotives. One locomotive is large, being about 65,000 pounds on the drivers, and the other two are smaller, having about 12,000 pounds. The larger engines do not handle any harder than the smaller ones as to the reverse levers, but do as to the heft of their valves, that is, as to the heft of the hearing. The rings are heavier, the rods heavier, and the valves larger. They do handle some harder (4684–4693).

H. P. CROWELL, witness on behalf of defendants, testified:

DIRECT EXAMINATION

Residence, Belfast, Maine; occupation, general manager of the Belfast and Moosehead Lake Railroad, having held that position about 6 years. In addition to the accidents at Rolerson and Burnham Junction, we had one other crossing accident on our road.

1295 It occurred at the bridge crossing within the city limits of Belfast, April 26, 1931. I made an investigation of the accident and the following facts are based on such investigation: (It was stated that the facts as to this accident, given in the other record were not material here. The record was allowed to show that in this accident there was nothing involved relating to the reverse gear on the locomotive).

I have prepared an exhibit which gives operating and financial statistics relating to our road over a period of years. Such figures were obtained from the records of the company and the annual reports to the Interstate Commerce Commission. We have on file in our office copy of our annual reports to the Interstate Commerce Commission. To the best of my knowledge, this exhibit correctly shows what it purports to show.

(This statement was received in evidence, marked "Defendants' Exhibit No. 47, Witness Crowell.")

C. F. SAGER, witness on behalf of defendants, testified:

DIRECT EXAMINATION

Residence, Wardensville, West Virginia. I am an engineer on the Winchester & Wardensville, in which capacity I have served 13 years. My previous railroad experience was with the Western Maryland Railroad. Length of service, eleven years, four of which I was employed as engineer.

The Winchester & Wardensville Railroad is 40 miles in length and runs from Winchester, Va., to Wardensville, West Virginia. We have one steam locomotive, Consolidated, 2–8–0 type. It is hand reversed and has the Stephenson link motion. I average 12 hours per day on duty as engineer on this road, from 3 to four hours of
1296 which time is spent switching and waiting. During the 12-hour period there is some idle time, some days an hour; some days two hours.

The locomotive has a seat box on the fireman's side with a lid on it and a cushion for the fireman to sit on. There is just a drop seat for the engineer. I find the clearance ample for my work. There is no interference with the reverse lever.

I have never been injured with the manually operated reverse gear, nor to my knowledge has anybody connected with our road. I have never had any difficulty in the operation of the reverse gear on the locomotives which I operate. I operate the reverse lever or Johnson bar sitting down. I never sit down in the cab when I am switching; I stand, looking out of the window. I can do that and operate the reverse with one hand and keep my head out of the window. I have operated a power reverse gear.

"By Mr. MILLER:

"Q. Have you ever asked to have a power reverse gear installed on the locomotive you now operate?

"A. I never did."

CROSS-EXAMINATION

By Mr. MCLAUGHLIN:

It was on the Western Maryland Railroad I operated power reverse. That has been 16 or 18 years ago. In my general railroad experience, both on the Western Maryland and this road, at times I

have found the manual lever harder to work than it is usually. Maybe the valves get dry and cause it to work harder. When the valve is dry, it makes the lever work hard. You have to pull it harder to work it. If you are running an engine of any size with dry valves and you want to hook up the engine, you have to use both hands and brace your feet, either against the foot brace or something. On large engines this is necessary in order to prevent being thrown by the force that you have to apply and the way the lever acts They are much harder to operate on the larger than on the smaller engines.

1297 As to whether I would take the same precautions if I had a dry valve on the engine I am now operating, it would be harder to work. I find, when reversing the engine in switching movement and I want to make a rapid reverse and I have steam in the cylinders, the lever works a little harder than usual; not much—as long as your valves are moving it lets your reverse lever free so that it works just as free if the cylinder is full of steam as it will any other time, but if you stop it and let your valves stop, when your cylinder is full of steam, it is hard to pull. When reversing the engine, we are usually standing still. I also find when the counterbalance spring gets out of adjustment it makes the lever handle harder. This makes quite a pull, as you have all the weight to lift up when you pull it back. If the counterbalance adjustment is such that it does not take care of the weight, the tendency of the lever when unlatched from the pocket is to go to the corner.

REDIRECT EXAMINATION

By Mr. Miller:

I have had no difficulties with dry valves since I have been on the Winchester & Wardensville, nor during that time have I been unable to clear the cylinders when they needed clearing. I have always been capable of opening the cylinder cocks if I wanted to clear the cylinders.

George W. Howe, witness for defendants, testified:

DIRECT EXAMINATION

I am a resident of Proctor, Vermont; am at the present time and for seventeen years have been superintendent of the Clarendon and Pittsford Railroad, during which time I have ran an engine, but never for any amount of time.

1298 The Clarendon and Pittsford is located between Proctor, Vermont and West Rutland, Vermont, 19 miles in length, part of the territory hilly; part of it flat.

We have four 0–6–0 type steam locomotives; two have hand reverse and two power reverse, the two largest. These locomotives were bought new by our road except one which was second-hand and had

only been used a short time, the no. 8, one of the 170,000. The hand reversed locomotives have piston valves (4694–4704).

We have three engine crews, one engaged in switching service exclusively for a period of eight hours a day. The other two crews, as a rule, do switching service from four to six hours per day. These crews, normally, would have very little idle time; at present, they have idle time. The engineers have to report 15 minutes prior to leaving time, which time is spent in oiling their engine.

The hand reversed locomotives have drop seats. We have no complaints from the engineers on these engines with reference to clearances around the reverse lever and the engineer's seat box; neither do we have any complaints from them in regard to the hand reversed locomotives. To my knowledge, we have had no injuries on our road either from the hand reverse or power reverse gear, nor has the hand reverse gear caused any accidents. As to switching, one yard is about 50 percent back-up and go ahead. In the other two yards, it is about 90 percent forward movement. To my knowledge, the reverse lever on our hand reverse locomotive has never jumped out of the quadrant; nor has the Johnson bar ever gotten away from any of our engineers. We have never been requested by any of any of our engineers to have the hand reversed gear on the locomotives changed to power reverse. The same engineers operate both the power reverse and hand reverse locomotives. The power reversed gear locomotives were purchased one in 1924; the other 1926, I think.

The last one was purchased new; no. 8, second-hand, equipped
1299 with power reverse gear. We used no. 8 for about two years and the results obtained from it were so satisfactory, in purchasing the second locomotive new, we had it equipped with power reverse gear, also. It was the same type as no. 8. The element of safety was given no consideration in its purchase. We have had no difficulties with either the power reversed or hand reversed gear on these locomotives.

C. W. SHAW, defendants' witness, testified:

My address is Stewartstown, Pa.; have been an employee of the Stewartstown Railroad for 45 years, the past 20 of which have been as general manager of that road which is 16 miles long and located in southern York County, Pa. This road has three steam locomotives, two of which are in present service. These locomotives are 2–6–0 and weigh, as nearly as I can tell, 38 and 33 tons on drivers. Our locomotive engineers are on duty from seven to three o'clock, about; one and one-half hours for dinner. We have one engine crew in service, about one-third of which time, daylight, is spent in switching service; at the junction end it is back-up movement and at the other end I would suppose half is head-on, coupled from the front end of the engine. Our locomotives are hand reversed and we have had no complaints from our engineers with regard to the manually reversed gear on them; no complains of any kind. In my 45 years'

service with my road, no one has ever been injured with a manually operated reverse gear nor have our engineers ever asked that the locomotives be equipped with power reverse.

CROSS-EXAMINATION

I am not an engineer nor have I had an experience in handling reverse gears. The engineers have never asked that we equip with any mechanical devices. We have the Franklin fire doors which were put on a year ago at the Commission's requirement.

1300 J. P. FRAIM, witness on behalf of defendants, testified:

My residence is Tylertown, Miss. I have been connected, off and on, for 30 years with the Fernwood, Columbia & Gulf Railroad, the last nine years as vice president and general manager. This road is located in south Mississippi, at Fernwood connecting the main line of the Illinois Central Railroad. Its length is 44.14 miles, and it runs through a rolling agricultural country from which the timber has been all removed and which is being developed agriculturally. We have a mixed train; our passenger service does not amount to anything. We have four steam locomotives; two are 2–6–0, one is 2–8–0, and one is 2–4–2, and they are hand reversed. As to what I know about valve motion, I have never had any experience as an engineer. When business is good and the mill is in full operation we have had as high as three engine crews; at present we have only one. At present our engine crew is on duty approximately six hours and makes one round trip over the road. Under normal conditions, we consider ten hours a day. The crews will probably average 12 hours when business is good, and they would make two round trips. We have only two switching points, Tylertown and Columbia, so out of the six hours' duty, I would say, the engineer spent an hour in switching (4704–4714). Our engineer reports 30 minutes prior to leaving, which time is spent in bringing the engine from the shop to the station, oiling it, and checking over it to see everything is all right. Our engineers have never complained about operating hand-reversed gears, nor have they asked to have the locomotives power reversed. So far as my knowledge goes, since I have been with the road, no one has been injured by hand-operated reverse gear. If a defect develops in the locomotive, it is the engineer's duty to report it to the master mechanic, and it is repaired immediately. I do not get the report from the
1301 master mechanic, so do not know the nature of the engineer's reports as to reverse gear.

CROSS-EXAMINATION

Both our engineers belong to the Brotherhood of Locomotive Engineers. They do not have a committee of adjustment. They have never complained to me about any of the locomotive's mechani-

cal devices, nor have they asked to have any installed. Before I left, I asked the engineers what they thought about installing reverse gear, and they did not think it necessary on our equipment. They told me they had not had any trouble with the manually operated reverse gear and, although I have not examined the work reports they turn in and do not know the nature of such reports unless it is a major part of some kind, when I asked them if they had had any trouble they did not complain. One engineer had been there about 30 years, I believe. I did not ask them if they had ever made any work reports on the reverse gear.

E. H. JONES, on behalf of defendants, testified:

My address is De Kalb, Miss. I am assistant to the president of the De Kalb & Western Railroad, with which company I have been connected for 15 years. The road is 16½ miles long and is in central east Mississippi, between De Kalb and Electric Mills and Sucarnochee. We have one engine crew and one steam locomotive, hand lever reversed, which at present operates about 7 hours a day. We would operate the same time under normal conditions. We operated two trips a day until the first of March, I think, when we lost the mail contract on one trip and cut our one freight trip off. Out of the seven hours duty, the engineer has about two and one-half hours' idle time. The freight trains move about 20 miles an hour; we have instructions not to exceed 10 miles an hour over the county highways. We have one State highwway protected by a gate.
1302 About two hours of the engineer's time is devoted to switching. Since I have been connected with the road we have never had any complaints from the engineer about the hand reverse gear, nor, so far as my knowledge goes, has anyone been injured with manually operated reverse gears; nor have the engineers ever asked that the locomotive be equipped with power reverse.

CROSS-EXAMINATION

Other than ordinary repairs, we have never had any complaints from the engineers about anything on the locomotives. We get the requests to repair reverse gear just as we get requests for other repairs. We have had mechanical fire doors for several years.

HARRY DEANS, engineer for the New York Dock Railway, testified:

DIRECT EXAMINATION

Address, Brooklyn, N. Y., I have been an engineer for the New York Dock Railway for five years. For seven years before I came to this road, I served as fireman and engineer of the Jay Street Connecting Railway, an all switching road. All of my service has been in switching service. The New York Dock Railway is located

on the water front, Borough of Brooklyn, East River; it goes running along the front of the piers. We have three 0–4–0 and three 0–6–0 locomotives. The 0–4–0 are coal burners; the 0–6–0 burn oil. Those locomotives are hand lever reversed, Johnson bar with steam brakes, no air in them. It is sliding-valve motion. We work eight hours a day. Beside running the engine, I watch the boiler. Aside from running the engine as an engineer, I have no other duties
1303 on the oil-burning locomotives. On the coal-burning locomotives, which I have operated, aside from running the engine, we bank the fire. Including the banking no more than a ton and a half of coal is used in the eight hours.

I work about five hours a day, six days a week, reporting one-half hour before leaving time. That also applies to engineers on coal-burning locomotives. I have operated coal-burning locomotives as an engineer a considerable portion of the time and have never during this time had any difficulty of any kind with the hand reverse gear nor do I know of any instance on our road where anybody has been injured with the Johnson bar or hand reverse gear. I have never had one of the Johnson bars get away from me nor have I had it thresh back and forth on the lever. In switching, we face whatever way the brakemen are standing. I have never been involved in any street, highway, or road-crossing accidents on our road. I have never asked that our locomotives be equipped with power reverse gears; I have never operated a power reverse gear locomotive and am not familiar with it except from going around and looking at it (T. 4714–4724).

S. B. MERRITT, secretary and general manager, Prattsburgh Railway Corporation, testified:

DIRECT EXAMINATION

Address, Prattsburgh, N.Y., have been employed by the Prattsburgh Railway Corporation, which is 11½ miles long and located in Steuben County, New York State, for 14 years. We have two steam locomotives, one 4–4–0 and the other 2–8–0 type. The total weight of the 4–4–0 locomotive, on drivers, is 60 tons; the 2–8–0 weighs 135,000 pounds. They are both hand reverse levers. When business is good and at the present time we have one engine crew. The engineer works ten hours, no idle time; it is daytime service.
1304 We have had no complaints from engineers with reference to clearances around the reverse lever and the engineer's seat box on the cab of our locomotives. I have observed engineers operating locomotives; he stands up when switching; when running in road service he sits down. To my knowledge, no one on my road has ever been injured with a manually operated reverse gear; nor during my supervisory capacity have I had any complaints from engineers with reference to them. They have never asked that a

power reverse gear be put on the engines. No engineer has had to be relieved from duty due to exertion due to operation of the manually operated reverse gear. In a day's work the locomotive travels about 23 miles. We use only one locomotive at a time.

CROSS-EXAMINATION

I am not a locomotive engineer. I never operated a reverse gear on the engine on our road but I know how it is constructed. I do not think I have paid any particular attention to the experiences of our engineers on the road handling the reverse gear. They have not asked for any equipment on the locomotives; only for repairs when necessary. By equipment I mean new or new mechanical devices. I do not think we have had to repair the reverse gears since I have been on the road, four years, during which time we have done all our work. Formerly it was sent out. I do not know whether we have adjusted the counter-balance spring in that time. I do not know those details. I have not examined all of the work reports as they were filed; not every day. I know there have not been any filed with reference to reverse gear. For four years I have examined the reports once a week; perhaps oftener. We have no repairs on the reverse gear that I can remember. My attention was called to this by reason of having to examine all the bills presented for the repair work. The shop generally specifies each item on which
1305 it works. It is true that they may have done work on the quadrant or the latch of the reverse gear without putting in a bill for it.

F. B. HAND, master mechanic for the Morehead & North Fork Railroad Company, testified:

DIRECT EXAMINATION

Address, Clearfield, Ky. I am a master mechanic for the Morehead & North Fork Railroad, which is located in Rowan County, at Clearfield, in eastern Kentucky; is 25 miles long and the nature of its traffic is freight. As to what the principal commodity we haul consists of, it is difficult to state. What little there is, is in box cars going to the farmers. Two days a week we make the run. We have two steam locomotives; the wheel arrangement is 2–6–0 and 2–6–2; they are hand reversed levers, equipped with Richardson slide valves. At present, one of the locomotives is in service, more or less, six days a week, anywhere from three to six hours per day. The engineers usually look their engine over and put in the time with some light repair work. As to the clearances on both of our engines: it will not interfere with the operation in any way, shape, or form. The quadrant sets on the platform and along the running board and comes back within three inches of the boilerhead. When the reverse lever is laid in the back motion he then has a clearance which does

not come by the boilerhead except a little bit. He then has a clearance of about 26 inches from the edge of the cap so he can stay down on the deck without any interference with anybody. I have had no complaints from our locomotive engineers with reference to the manually operated reverse gear. The engineer is furnished with work reports with instructions to make them out and show up any defects, so he certainly does report anything mechanically
1306 wrong with his locomotive on his work report, which comes to me. I do not know of any instances where there have been any serious defects reported on the reverse gear; some of a minor nature—a spring might become defective or something of that kind on the latch. When something of that nature is reported, it is immediately repaired. As an engineer I would not let anything like that go out. I don't think any of our locomotive engineers have ever had to have any assistance in operating the Johnson bar at any time—never that I knew of; nor have I ever known of the Johnson bar getting away from an engineer on our road. There is a foot brace on our locomotives. He can stay on the box and place his foot against it and reverse every one of my engines with one hand, the way they are balanced. Under my supervision, the Johnson bar has not threshed back and forth on the quadrant on our locomotives but I have heard of such things occurring on other roads. We have no trouble with the Johnson bars at all; we seat them to keep them in perfect working condition. When switching, our engineers, in backing up, can either let down his drop seat or stand or he can sit on his drop seat and look out of the window. Sometimes we have trouble with foaming water; as a rule our water is good, not foamable, but in case of heavy rains or something like that we sometimes get that material which causes foaming; it is a trouble that comes and goes (T. 4724–4734). If it shows up seriously, I change the water in the boiler immediately. If not serious, I have a blowoff cock made on purpose that can be blowed at any time and a portion of that would be blowed off. As to difference made by foaming water in the operation of the reverse gear lever: any water going into the cylinders would make a severe change in the valve. After it would wash the lubricants from the walls it certainly would
1307 make it hard. Foaming or engineer's carelessness to foaming is the greatest detriment that the slide valve has ever had. They are not made to run water but dry steam. We have had cases on our road where the reverse lever has worked hard account of foaming water but only for a little while; it was speedily taken care of and changed; if the engine were to foam a little bit getting up some hill or working on a grade, it would bring a substance that would retard the movement of the valves to a certain extent and also wash the oil off the walls of the cylinder, but that would be eliminated by a speedy flow of oil in there again, when it soon becomes easy again. I don't think for one minute that the foaming water and the reverse lever worked so hard as to cause the engineer to need assistance in throwing the Johnson bar. I would consider

that an awful extreme and a question as to whether the mechanism of the gear pins, etc., would stand the awful strain. They are not apt to.

No one or our road has ever been injured with a Johnson bar or manual reverse gear. As to having difficulty with dry valves, if you happen to let the lubricant fail, they would go dry; if such a situation has occurred on my road, it has not been called to my attention. We are fortunate enough to have an engineer on our road who was made there and has been with the company for many years—only time he was absent was while he was in France; he works every day. He has never complained about having to reverse our engines with hand reverse gears; nor has he ever mentioned to me putting a power reverse gear on our engines and if anyone would have the right to mention it, it would be him. I do not think he weighs over 116 pounds.

September 24, 1931

JESSE L. BLESH, defendants' witness, testified:

DIRECT EXAMINATION

1308 Residence, Conifer, N.Y., I have been a master mechanic for the Grasse River Railroad for 15 years. I have had some experience as a locomotive engineer on the Grasse River Railroad, which is located in northern New York between Childwold and Cranberry Lake, N.Y. It has no heavy grades nor sharp curves. We have three steam locomotives; two of them use coal and in one we use oil fuel. They are all 2–6–0 locomotives and the same weight, hand reversed. We have one engine crew; and one locomotive only in operation at one time. At present, our engineer is on duty ten and one-half hours per day, of which I would say at present the locomotive is in use three hours. Probably one and one-half hours devoted to switching, all in daytime. The location of the reverse lever on both the oil- and coal-burning locomotives is the same; it is on the left side of the engineer, who has a drop seat box. I have never had any complaints from him about the clearances around the reverse lever and the seat box; I found those clearances adequate when I was operating the locomotives. When operating reverse lever in road service, it is the practice of the engineer to sit down. I sat down while I operated in road service. As to the amount of strength required to operate the reverse lever, either in reversing the locomotive, hooking it up or dropping it back, it reverses very easily; I have never required assistance in handling the Johnson bar; nor do I know of any instance where our engineer has required such assistance. None of our engines have foot braces; neither has the engineer ever asked to have them installed. We have no order boards nor block signals on our line; we cross two State highways; in approaching which, they come to a dead stop before they cross.

We also have to cross some county roads and township roads; ordinarily the train moves from 12 to 15 miles in approaching and crossing those crossings. We have never had any ac-
1309 cidents on those crossings. No one on our road has ever been injured with a manually operated reverse gear. Anything mechanically wrong with a locomotive is entered by the engineer on his work report, which comes to me. I know of one instance where an engineer reported a defect in the reverse gear—the reverse spring broke; the equalizing spring broke on the reverse gear. We had it fixed. I know of no instances where the reverse lever has jumped out of the quadrant. The instance I just mentioned was the only one I know of where there was a deficiency in the operation of the reverse gear. In that case the counterbalance spring, which equalizes the reverse gear, broke. We have no trouble with leaky dry pipes, dry valves, or water troubles on our road. Our engineer has never asked to have power reverse installed on any of our locomotives.

CROSS-EXAMINATION

Our engineer has never asked that extra mechanical devices be installed on our locomotives (T. 4734–4744). In normal times we convert our coal-burning engines into oil for the summer; to convert it from coal to oil and then back it costs somewhere around $500 or $600 for each engine once a year. I mean to convert it from coal to oil and then back to coal again.

My experience has been that when there is steam in the cylinder and I want to release the lever, it works harder; also if the lubrication does not flow freely and I get dry valves, that makes the lever handle hard but that would not cause the lever to jump out of the quadrant—I have not had that experience. If the equalizing spring broke that would cause the lever to handle harder.

"Q. Under what circumstances, if any, did this equalizing spring break that you told us about?

"A. I imagine he was reversing the engine or running along."

1310 I do not know what he was doing. If he was attempting to hook up the lever and the spring broke while he had hold of it, I do not see that it would be a dangerous proposition for him. I do not think it would give him any kind of jerk. I do not think there is enough pressure there to jerk the lever from him. It would have the effect that it would make the reverse lever work a little harder in one motion. It would throw all the weight of the links on him when the spring broke. I could not say that it would jerk him. One never broke with me. I would not want to say. I could not say how much tension you have on that spring. It is probably a coil spring of half-inch wire; about 16 to 18 inches long.

1311 R. J. SAWYER, defendants' witness, testified:

DIRECT EXAMINATION

I have been superintendent of the Berlin Mills Railway for four years; prior to that I was superintendent of car-repair shop with supervision over repairs and rolling stock for four years.

The Berlin Mills Railway is entirely engaged in switching service—no passenger service. The road is located with terminal yards at Berlin and Cascade, N.H., and a main connecting line with one and one-half miles between yard-limit posts; total trackage, 25 miles, approximately,—1½ miles main line, balance switch tracks. We connect with the Boston & Maine and Grand Trunk, both class 1 lines, at both points. The heaviest grade on our 1½ miles of main line is 3.7 percent; maximum curve on main line between 11 and 13 degrees. As to class and type of locomotives we use: two 2–6–2's, Walscheart piston valve motion, 126,000 pounds on drivers; three 2–4–2's, Stephenson link—slide valve motion, 94,000 pounds on drivers. All are saddle-tank locomotives. These locomotives have hand-operated lever gears. The engines are not superheated. They move from 5 to 7 cars at one time, on an average. Our crews work eight hours per day, six days a week, one shift working at night. Practically the entire eight hours is spent in switching, except one hour out when enginemen and crew are awaiting orders. Engineers spend full shift on the engine.

The reverse levers are located within easy reach of the engineer's seat on right side of engines, at left side of the engineer and slightly to front of engineer's seat. Engines have drop seats.

"Q. What have you to say with reference to clearances around reverse lever and with relation to engineer's seatbox?

"A. We have ample clearances from all side for safe and convenient operation.

1312 "Mr. STEVENSON. We object to that as a conclusion on the part of the witness. He stated they are ample.

"Mr. ROGERS. The answer may go out. Tell us what the clearances are.

"Ex. ROGERS. Can you give it approximately? inches

"WITNESS. I can change that by saying that the clearances are such that an engineer can pass between the seat and the lever and reach anything he wants to without the lever interfering with him, but I cannot give you the inches on it.

"Ex. ROGERS. That will be sufficient.

"WITNESS (continuing). The quadrant is about 14 inches from the running board or floor board of cab at highest point. The reverse lever is 32 inches high. When the lever is in extreme back position there is no difficulty in reaching any appliances on the boiler head. Our engineer does not require assistance to operate the reverse lever.

There are foot braces on our engines, but they are seldom used. I know they are seldom used from riding in the engines with my engineers and watching them work and operate. I think that will be explained as we go along. They are used if the engineer desires to stand. He may use these foot braces to steady himself to throw his Johnson bar."

We have one ball and five block signals on our road. We have one street crossing, which is protected by crossing tender, and engines stop for signal before proceeding. We have no state highway crossings.

The switching movement is about equally divided between back-up and forward.

"Q. Have your engineers ever been injured by reverse lever jumping up or getting away?

1313 "Mr. McLaughlin. I object; the witness is not qualified to know that.

"Ex. Rogers. The objection is sustained unless the witness can show qualifications for the answer.

"Witness. The only qualifications I can give is that I have worked 28 years with this company, not as superintendent of the railroad all the time, and we have men that have operated locomotives in our yards for 36 years, and, being interested in this case, I asked these engineers their opinion, if any of them had ever been hurt through operating that lever——

"Mr. McLaughlin (interposing). We object to what the engineers told him.

"Witness (continuing). From my acquaintance and relations with these men in my employment, I would know whether or not any of them would be injured. We have forms covering any injuries. Since I have been there, an injury would be reported to me as a matter of routine on our railway.

"Ex. Rogers. The most that you can say, I take it, is that so far as you know there have been no injuries?

"Witness. Well, I will say that, then."

Our engineers have never complained of the manual levers. We have never had to repair any broken Johnson bars on our engines. I would not say that we had ever to repair any parts. We have had to replace worn parts as they developed.

As to what are our objections to the installation of the reverse gear: We are purely a switching road, and our engines are smaller than the ordinary locomotives, and they are more compact, and they are easily operated. Our engineers are not pressed for time. They have never offered any complaint about the hand-operated levers. Aside from the expense, on our newer engines we would be compelled to make more than ordinary changes because of the compact design of our engines. It would require substantial

1314 changes to install this equipment.

(Photograph of no. 9 locomotive developed and built by Baldwin Locomotive Company in 1929 was received in evidence, marked "Defendants' Exhibit 48, Witness Sawyer." It was also stated a sister locomotive of the same type and description was built.)

(Witness continues.)

The 2–4–2's are saddle tank locomotives with coal tenders on the rear, practically the same as no. 9. We had an estimate made by an outside master mechanic covering cost of putting air-operated (I do not know which type) power reverse gears on no. 9, and it will run between $500 and $700. That would include the necessary changes that we would have to go through, and change our air system and change our piping, and so forth, and get clearances to get the stuff on to our locomotive. If you look over the exhibit, we are pretty well crowded there with air tanks and stuff in the length we have of the engine. Our drivers are crowded together there, and we are pretty well crowded for room as it is. We have both the straight American air and the automatic air on this locomotive. This included the cost of the gear itself, providing we were going to get this gear. We were going to have the Boston & Maine Railroad install this, and they were going to furnish us with a suitable used layout, recovered material, and save us money (T. 4744–4756).

CROSS-EXAMINATION

We have the old straight American air, they call it, brake on our locomotive. There are letters on it which I cannot recall. We also have an automatic air. I cannot tell you how high in inches the brake valves of those connections are from the deck, but I can tell you that they are so that when a man is either standing or sitting on the engineer's seat they are within easy and comfortable reach to operate. They are so that they give ample clearance over
1315 the top of your Johnson bar, so that there is no interference with your Johnson bar operation. When the Johnson bar passes over center, it is 32 inches higher than your quadrant, and your quadrant is 14 inches high at the highest point, nearly four feet high. As to whether my air brake valve is higher, yes. It is about here [indicating]. I am not an engineer myself, so I have never operated the Johnson bar and the brake valve at the same time, but I have seen an engineer operate the Johnson bar and have his hand on his brake at the same time. If you want me to describe how they do it: You have your drop seat and the engineer steps around here with his foot on the quadrant, and he can reach his air valves here and grab his operating lever and swing the lever and straighten up. If he wants to he can straddle the quadrant with one foot on one end and the other foot on the other. I

am not saying they do, but I am calling to mind one particular one. I think they all do it.

"Q. You have observed that they use the quadrant as something to stand on when they are looking at their injector to get a better look at it?

"A. On these locomotives we have a step for that. That is attached to the boiler, and the lagging comes out over it and he can step from his platform onto that step. I do not think that I have ever seen him step onto the quadrant in getting onto that step nor have I ever observed him step across the quadrant when the locomotive was in motion to get a drink of water. The quadrant is located alongside of the boiler. It does not project back by the end of your boiler. It is directly on the left hand of the engineer and slightly forward of his seat. As I said before I could not tell you the space, in inches, between the top of the Johnson bar and the boiler when the lever is being operated. It is more than two inches. The boiler curves. Necessarily, down farther on the Johnson bar it comes closer to the boiler than at the top of the bar. I am
1316 going to guess and say that it is between 4 and 6 inches of the boiler at the middle of the bar or wherever it is closest. Our engineers have asked for air bells and when I developed these new locomotives I put the air bells on them; they have asked for improvements but they have never asked for power reverse. It was not necessary for them to ask for air fire doors because I put them on—between 1929 and 1930. The new models came equipped since they were not built until 1929. If I remember right, the Commission's order requiring them is about 4 years old.

I am not a locomotive engineer, and only know of my own knowledge whether the manual lever operates easily or not, only that I have operated it with an engineer there with me. I have driven these engines a little, you know. I will not say that I had ever operated an engine under heavy load or when I had anything to bother me.

As to compactness of no. 9 with reference to wheel centers compared with the ordinary railroad engine: We are crowded up more than any ordinary engine. If you look at the levers there you will see that it is a compact job to get your brake shoes on to your drivers there.

"Q. What is the distance between the wheel centers on this engine and on other engines?

"Mr. Dow (interposing). You mean other engines on this railroad or some other railroad?

"Mr. McLaughlin. On other railroads; the usual yard engine.

"Witness. That is too broad a question for me.

"Mr. Rogers. I think that is too broad. There is too much of a variation between other locomotives.

"By Mr. McLAUGHLIN:

"Q. What is the distance between the wheel centers on this locomotive, no. 9?

"A. To verify me, it is right on the back of the card, I
1317 think."

"Examiner ROGERS. That is the wheel base?

"WITNESS. Well, I can give you that exactly, I think. The wheel base on the drivers is nine feet, no inches. The total length of the engine is 24 feet, five inches.

"Mr. McLAUGHLIN. I do not think that answers my question.

"Examiner ROGERS. I do not believe that the witness knows what the wheel centers are."

"By Mr. McLAUGHLIN:

"Q. As a matter of fact, you have no accurate knowledge of the comparison of wheel centers on this locomotive compared with any other locomotives, have you?

"A. No; only that it is more compact.

"Q. How do you know that?"

"Examiner ROGERS (interposing). What has the wheel center got to do with it?

"Mr. McLAUGHLIN. I take it that that may have some bearing on his statement that this engine is so compact that power reverse could not be applied; that there is not room for it. In our opinion, the wheel centers are not any different on this locomotive than the ordinary switching locomotive of its size.

"Mr. Dow. If that is true, why not let counsel show that information as to other locomotives?

"Mr. STEVENSON. Why not strike the witness' answer that it was compact. We do not have to prove it. It is his case.

"Examiner ROGERS. Almost anybody knows that a saddle tank locomotive is compact.

"WITNESS. That is why we offered the exhibit.

"Examiner ROGERS. Let us not get into a lot of argument here, gentlemen. Are there any further questions of the witness?"

"By Mr. McLAUGHLIN:

"Q. I would like to inquire of you on this exhibit whether there is an air tank on the right-hand side of engine no. 9 underneath the running board?

1318 "A. Yes; there is an air reservoir.

"Q. Is the remainder of the right-hand side of the engine as clear as the picture shows the left-hand side to be?

"A. Yes; I would say so."

"Examiner ROGERS. Where is this air reservoir; on the right-hand side or on the back of the cab?

"The WITNESS. It runs off this way [indicating].

"Ex. ROGERS. Alongside of the fire box?

"WITNESS. No. Here is your platform [indicating]. The air cylinder is located almost like that [indicating].

"EX. ROGERS. The air reservoir?

"WITNESS. The air reservoir. Then there is another air reservoir that stands up here [indicating].

W. B. VARNER, defendants' witness, testified:

DIRECT EXAMINATION

I reside at High Point, N.C. I have been an employee of the High Point, Thomasville & Denton Railroad for 20 years; about 8 years as fireman; five years as engineer and the last seven years as master mechanic. We have eleven locomotives on our road, type and weight on drivers correctly described on exhibit 41. Nine of these locomotives are manually reversed and two power reversed. During the latter part of 1923, we purchased one second hand, already equipped power reverse engine from the Richmond, Fredericksburg & Potomac Railroad; we had the other built new in 1924, specifying it to be power reversed, and the power reverse gear was applied by the builder. Our company placed the order for the new locomotive and I had something to do with its specifications, in a small way. It is the no. 750, the 2-8-0, 122,000 pounds weight on drivers.

1319 We operate one through freight train with one engine crew engaged in that service. The engineer in that service is employed 10 hours each day. His switching is nothing more than coupling the engine to the train and setting the train off. We weigh some cars, too—don't know whether that would be switching. We have one local freight train (T. 4756–4766); engineer works nine and one-half hours per day, of that time switching about three hours per day. We have one engine operating in yard service exclusively, ten hours per day.

Both of our power-reverse engines are stored—neither is in operation.

To my knowledge, we have never had anyone on our road injured with a manually reverse gear or Johnson bar on our hand-reversed locomotives. I cannot say that I have operated every one of these locomotives but on the ones I have operated I have had no difficulty with the clearances around the reverse lever and the engineer's seat box; nor have I had any complaints from the engineers with reference to such clearances. When I did operate these engines, in switching I usually stood up between stations; running along the road, of course, I sat down. Some folks can operate the Johnson bar on those locomotives, while sitting down, the 12-wheelers. I am just a little too large [weight around 255 pounds]. The Johnson bar never got away from me; nor from any of our engineers, to my knowledge; nor since I have been master mechanic have I had any complaints from our engineers with reference to the Johnson bar or

manually operated reverse gear; nor have they had any difficulty in operation so far as the reverse gear was concerned.

We have four highway crossings and several minor highway crossings.

1320 Our freight trains move approximately 15 miles an hour when approaching these crossings.

When there is steam in the cylinders of the locomotive, naturally, it would be more difficult to move the Johnson bar from one position to another. I have operated the Johnson bar with steam trapped in the cylinder and had no difficulty in clearing the cylinders of steam when necessary.

CROSS-EXAMINATION

I think dry valves, account of lack of lubrication, would make a lever handle harder; also, it would be more difficult to hook up over the road with dry valves.

As I remember it, the power reverse on the engine we purchased from the R., F. & P. was the old Lewis gear, which has been awfully bad to creep. Anybody will tell you that. On the locomotive we had built new in 1924, the power reverse is the Alco which has been satisfactory and we have had no difficulty with it creeping. We got the engine in July 1924 but it has operated very little since 1927. We soon outgrew the engine. As to whether during those three years it went from one shopping to another without any particular attention to the power reverse: I would not want to say it never had any attention except at shoppings. Nothing more than routine—that is all.

The 4–8–0 engine we were discussing was built in 1924. The others were built at various times—they are all alike; one in 1900; one in 1902 or 1903. We have five just alike. They are older than the power reverse engine ordered in 1924. I offered no objection to the application for Alco gear on the new engine.

H. R. MILLER, defendants' witness, testified:

DIRECT EXAMINATION

I live at Williamsport, Pa. I am master mechanic for the Susquehanna & New York Railroad Company, which road is 44 miles long; has general offices at Williamsport; and operates between Marsh Hill Junction and Towanda. We have six steam locomotives, one 4–4–0 and one 2–6–0 types, both manually reversed; also four 2–8–0 Consolidation type, one of which is power reverse and the other three manually operated. The power reverse is a no. 118, the largest we have; it is used in freight service and was purchased from the New York Central in 1926. The 4–4–0 is used in passenger service; the others in freight. The same engineer who operates no. 118 also from time to time operates nos. 114, 115, and 116; the locomotives are more or less in pool operation. Two of our hand-reversed

locomotives are equipped with sliding valves and four with piston valves. Four of our locomotives are superheated.

Our locomotive engineer in through or fast freight service switches to the extent only that he sets out and picks up a train; in the course of a day's work, from one to two hours. In our other freight service, as a general rule, I would say the engineer spends about three hours switching. Our engineers report for duty 15 minutes prior to leaving time, which time is spent in preparing the engine for the run—oiling it. We have never had any complaints from our locomotive engineers with reference to the reverse gear on the hand reversed locomotives; nor having to operate them; nor have any engineers or anybody else on our road, to my knowledge been injured by the manually operated reverse gear or Johnson bar. I have never had to furnish assistance to any engineer in operating the Johnson
1322 bar; nor have any of the engineers asked me to have the hand reversed locomotives equipped with power reverse.

To my knowledge, we have had no accidents of any kind with hand reverse gears. As to our power reverse gear, which is a Ragonett, type A, we have had no particular trouble—we have renewed the piston packing frequently.

CROSS-EXAMINATION

I have had no complaints from engineers on our road as to manually operated or power reverse gears nor have our engineers asked for any additional devices on the engines at any time (4766–4776).

H. A. GIBSON, witness for defendants, testified:

DIRECT EXAMINATION

I live at Sheffield, Warren County, Pa. For the past 19 years I have been superintendent of the Tionesta Valley Railway; for ten years prior to that time I was fireman and extra engineer. This road is a lumber road, narrow gauge, 30 miles long, and located in Warren County, Pa., passing thru the corner of Elk and Forest Counties.

We have 2–6–0 type and geared locomotives, all hand reversed, on our road. At present, we are using one 2–6–0 and two geared locomotives. The 2–6–0's are used 10 hours a day, two and one-half to three hours idle time for engineer. The geared engines are used 10 hours a day—about two-thirds of the time is standing by—governed by the condition of loading logs by the loader.

The manual reverse gear on the geared locomotives differs in mechanism from the manual reverse on the rod locomotive in that it works with a reversal arm on the links, which reverses very easily. The reversing arm is on the links with a ball and socket joint attached to the end of the reversal lever, which gives it an extra power in the handling of the reverse lever.

1323 As to whether the rod or geared locomotives, under similar conditions and being the same size, would be easier reversed, the Heisler, I think, is the easier. It is very simple. We have had no complaints from our engineers with reference to, nor have they or anyone on our road been injured by, hand-reversed gears; they have never asked to have the engines power reversed. I am not familiar with power reverse.

The geared engines approach State highway crossings at 4 miles an hour; the others at a speed under control. I never knew of any accidents involving reversing gear at these crossings.

(It was stated that an exhibit would be furnished later, giving additional information as to the design and weights of the geared engines.)

CROSS-EXAMINATION

The maximum speed a geared engine could make would be 10 miles an hour.

C. J. FIELD, witness for defendants, testified:

DIRECT EXAMINATION

I live at Fredericksburg, Va. I am vice president in charge of operation of the Virginia Central Railway, with which road I have been connected since the fall of 1926, when it was converted from a narrow to a standard gauge railroad. It is located wholly in the State of Virginia and extends from Fredericksburg, where it connects with the R. F. & P. R. to Orange, Va., where it connects with the C. & O. and Southern. I am familiar with the operating conditions of and the territory served by the railroad. It has 38 miles of mail line, with 3 miles of sidetrack. It is engaged in interstate and intrastate commerce of passengers and property, with a gasoline-motor service for passengers and steam-locomotive service for freight trains.

1324 Our road operates one passenger and one freight train each way daily, except Sunday.

We have eight locomotives, equipped with satisfactory power reverse gear. We have four Chesapeake & Ohio locomotives, two of which are G–7's, one G–9, and one G–17, weight on drivers, 199,000 pounds. Of the other locomotives, one is a 35 ton. I do not recall the tonnage of the light locomotives which were retired account too light for service; I do not know the type of power reverse gear on them; they came from the other line. I think our first power-reverse-geared engine was purchased in the latter part of 1927; they came to us equipped. We have had no trouble with the power reverse.

W. B. WILLS, defendants' witness, testified:

DIRECT EXAMINATION

Residence—Belleville, Pa. I have been connected with the Kishacoquilas Valley Railroad Company for 20 years; for the past 7 years as assistant general manager; prior to that period I served as conductor and engineer. I ran as engineer for a couple of years. I fired for the Pennsylvania about six years and four months, prior to coming to this road.

On our road we have mixed train service, passenger and freight, running on schedule. At present in this service we ordinarily haul 6 or 7 freight cars and 2 coaches in a train—under good business conditions, a train would consist of 12 or 14 cars and 2 coaches.

At present we have four steam locomotives, one of which is no. 6, a 4–6–0 type, 84,000 pounds on its drivers, manually reversed Johnson bar. No. 1033 is a 4–4–0, 100,000 pounds on its drivers, manual reverse. No. 3, also a 4–4–0 type, approximate weight, on drivers, 30,000 pounds; is hand reversed. Of these four locomotives, nos. 6 and 1033 are superheated (T. 4776–4786).

1325 We have two engine crews regularly employed but work one at a time unless we have a work train out. Engineer is in service about 12 hours per day, about three hours idle time; about three hours a day consumed in switching service; he reports about 15 minutes prior to leaving time, which time is spent in oiling and getting his engine in readiness to go. Our regular engine crew works seven days a week. As an engineer I have run the three engines, previously described, on this road. I have never had any difficulty with the clearances on any of them with reference to the Johnson bar and the engineer's seat box; nor have any of our engineers complained to me about those clearances. During my time as an engineer on our road, the Johnson bar never got away from me; nor threshed back and forth; neither did it jump out of the quadrant—in short, I never had any difficulty of any kind with the operation of the Johnson bar on any of those locomotives. My engineers have never complained about having difficulty in operating the Johnson bar nor, to my knowledge, has anyone on our road been injured with the manually operated reverse gear. I have never had any trouble with operating the Johnson bar with steam in the cylinders nor have I had any difficulty with dry valves. If the engineers ever did, they have never reported anything. I never had any trouble on the locomotives with leaky, dry pipes; neither have I had any report from our engineers on that subject.

About one-half of the time consumed in switching service is taken in switching the yard. As an engineer operating the locomotive in back-up switching, I sat on the seat box with my head out of the window to get the signal and it was possible for me to operate the Johnson bar or reverse lever at the time that I kept a lookout

1326 ahead for crossing or signals I had to observe. I was never prevented from performing any engineering duties due to having to reverse my locomotive by manually operated reverse gears.

W. B. WILLS

CROSS-EXAMINATION

When I was firing I operated some of the manually operated Pennsylvania locomotives but I did not handle them a whole lot. They were large consolidation engines. I do not know what they weigh; around 100—I have never handled them with steam in the cylinder.

I do not recall ever handling the lever on our small locomotives when I had steam in the cylinder. Not that it interfered with the handling of the reverse lever. The reverse lever on our locomotives is to the left of the engineer, in front of him, or to the side. When the lever is put in full forward motion I should say it was a couple of feet from the front end of the seat box. So you can reach
1327 over with one hand and get it but you don't have to get off your position to do it; drop seat half way between.

"Q. When you are taking signals from the rear, in what position do you sit on the seat box?

"A. You can turn that way [indicating].

"Q. Turn with your back toward the front of the locomotive and with your face toward the tender?

"A. Yes; face the tender.

"Q. You do not mean to tell us that in that position you can reverse the engine and put her in forward motion without bringing your body inside of the cab, do you?

"A. Yes; you can do that. The reverse lever handles very easily.

"Q. You bring your hand and shoulders inside of the cab when you put the engine in forward motion, don't you?

"A. Not necessarily; not in the position you are in.

"Q. Do you ever need to bring your head and shoulders inside of the cab to put it in motion?

"A. It is not necessary, with the location of the seat; in this location.

"Q. How do you do it?

"A. That is the way I do it; sit on the seat and throw the lever with either hand.

"Q. Can you reach the lever when it is in full forward position and at the same time keep your head and shoulders out of the window?

"A. Yes.

"Q. Is the lever always as easy to move as you indicate with your hand, a slight motion of the wrist?

"A. Ours move very easily on the small engines.

"Examiner ROGERS. If you are looking out the window, don't you have to lean back a little bit in order to get your head out?

1328 "WITNESS. You can look either way. Your lever is in front of you.

"Examiner ROGERS. When you have your head out of the window that way can you still do that?

"WITNESS. Yes; you can reach quite a ways.

"Ex. ROGERS. Wait a minute. Can you still do that and reach over and get your lever and unlatch it and put it from one end of the quadrant to the other?

"WITNESS. Yes; with the position our drop seat box is in.

"Ex. ROGERS. Still leaning backward with your head ouside of the line of the cab?

"WITNESS. Yes; with your back against the window, looking either way. You might not be able to do it with all locomotives, but we have our drop seat fixed for that purpose along the side of it."

"By Mr. MCLAUGHLIN:

"Q. You say the lever is two feet away from your seat box when in the forward motion?

"A. I imagine it is.

"Ex. ROGERS. How far is the lever from the side of the cab? You say it is 2 feet away from the seat box?

"WITNESS. The seat box sits alongside of the quadrant.

"Ex. ROGERS. How far is the quadrant away from the side of the cab?

"WITNESS. I imagine it is 20 inches.

"Ex. ROGERS. How much of a seat box or drop seat do you have?

"WITNESS. Drop seat. It is about 14 inches, I imagine.

"Ex. ROGERS. Where is this two feet you were telling us about?

"WITNESS. From the direction—each end of the quadrant, I imagine.

1329 "Examiner ROGERS. We asked you how far it was from the reverse lever to the seat box, as I understood it.

"WITNESS. That is when it is in full motion forward. Is that it?

"Mr. MCLAUGHLIN. Yes.

"WITNESS. That is about 2 feet forward when it goes in the corner. When it is set up alongside you it is only a short distance away from you.

"Examiner ROGERS. How much clearance is there between the seat box and the reverse lever?

"WITNESS. I imagine 6 inches or somewhere along there.

"Examiner ROGERS. How long is your arm?

"WITNESS. I never measured it; 30 inches, is it not?

"Examiner ROGERS. I do not believe you have any 30-inch reach.

"WITNESS. I believe I have a pretty good one.

"Witness continuing: I fired for six years and four months on the Pennsylvania before coming to this road; I do not recall ever observing an engineer having difficulty with the reverse lever."

REDIRECT EXAMINATION

The drop seat on the engineer's side of the cab is a double-spring drop seat; it sets up on a post; to let it down you first kick the post out from underneath it.

GEORGE REITH, defendants' witness, testified:

I live in Kingwood, W.Va. For the past 13 years I have been general manager of the West Virginia Northern Railroad, which is in Preston County, W.Va., and has 11 miles of main line. Prior to my service with this road, I was 3 years on the Grand Trunk and 15 years on the Chicago Great Western. I have had no experience as a locomotive engineer (T. 4786–4796).

1330 We have four steam locomotives on the West Virginia Northern, all 2–8–0 Consolidation type. None of them are superheated. Nos. 8 and 9 weigh 125,000 pounds on drivers, are hand reversed and are equipped with Stephenson valve motion. Nos. 11 and 12 weigh 135,000 on drivers and have the Walscheart motion. These locomotives switch coal mines; at present one is used at one time—three days a week. Under normal conditions from 2 to 3 would be used daily about 8 to 8½ hours a day.

Our road crosses State highways and a number of county or township highways. The speed crossing these highways is about an average from 8 to 10 miles per hour. As a safety precaution in approaching these crossings, I require the engineer to sound two long and two short blasts twice for each crossing and turn on the air bell ringer at the whistling post and leave it on until after passing the crossing. The engineer operates the air bell. We have had no personal injuries at these crossings—only two minor accidents. I have never heard any complaints from any of our engineers about having to reverse these levers by hand.

When anything is mechanically wrong with any of these locomotives, the engineer is required to fill out a regular form at the end of his trip making a note of such defects, whereupon, the master mechanic takes the report and makes the repairs with the assistance of the boiler maker. When the repairs have been made the master mechanic places his O.K. and initials on the face of the form and files it away in his office. About two weeks ago I examined these reports for the past two or three months of this year. In the regular course of my work, I go to the shops every day or nearly every day when in Kingwood and I frequently examine those reports. I do not recall having seen reports showing defects in

1331 the reverse gear. I have never heard of a case where the Johnson bar has jumped out of the quadrant or gotten away

on any of our engines. I have never known of a case on our road where anyone has been injured with a manually operated reverse gear nor have any of our engineers requested that our locomotives be equipped with power reverse gear.

CROSS-EXAMINATION

To my recollection, none of our engineers have requested mechanical devices installed on our locomotives. We installed mechanically operated fire doors at the order of the Commission. I have never heard our engineers complain about the mechanical devices on the engines—I have heard them come off the road and say the air pump needed packing, something like that; but no particular complaints.

"Q. As a matter of fact, you have never paid any particular attention to the reverse-gear reports as they are turned in by the men except this time when you looked at the reports two or three weeks ago?

"A. No; I haven't noticed any reports regarding the reverse gear at all.

"Q. You never looked for them particularly, did you?

"A. No, sir.

"Q. What are some of the reports that you remember seeing on these daily work reports?

"A. Well, I have noticed several reports in connection with the air pumps. We have two air pumps on each engine. Some times they need repacking. There is quite a little trouble with the sanders. We have a good deal of trouble with our sanders on the 32-degree curves, keeping sand on the rail. They sometimes report the sanders being clogged up or needing adjustment and sometimes they report the brake rigging needing repairs."

1332 DIRECT EXAMINATION

W. J. HAYWARD, defendants' witness, testified:

I have been superintendent of the Chesapeake Beach Railway for the past 30 years with headquarters at Seat Pleasant, Md. This road is 28½ miles long; runs between the District line and Chesapeake Beach, Md., and renders both passenger and freight service.

We have five steam locomotives, two of which have a wheel arrangement of 4–4–0; are 55-ton engines and weigh about 40 tons on the drivers. There are times when we use any of the five in either passenger or freight business, but we aim to use the two 4–4–0 engines in passenger business. One other engine is a ten-wheel, that is, 4–6–0; weighs about 90,000 pounds; that is 45 tons on drivers. The other two are Consolidated engines, 2–8–0, weighing about 65 tons on drivers. We do not use all five of those engines any time.

When in passenger service, the fireman makes two round trips a day—one hour each way. Actual time on road four hours. They go on duty at 6:40 a.m. and get off duty at 10:30 a.m., relieved until

3 p.m., when they make another round trip getting thru at 6:30 p.m., but of that seven hours they are actually running four. During that time the fireman is called upon to shovel about a ton of coal an hour, 4 tons. The ten-wheel engine is usually used in freight service. We do not operate a straight freight train. We have not operated a train in straight freight service for several years. The passenger train I spoke of makes one round trip as a straight passenger train and the other trip is mixed. Our firemen start out at 6:40 in the morning and they get through at 6:50 in the evening but they have several hours layoff during that time. They are off duty entirely from 10:30 a.m. until 3 p.m., when they go home. I don't think locomotive firemen are ever called upon to shovel more than one ton of coal an hour, on our road.

1333 We have three State highway crossings on our road, one of which is overhead; the others are grade crossings. We also have a number of minor farm crossings, four of which are overhead crossings. All of these are not at grade. As to the number of highway crossings at grade on entire length of our road, we have a great many farm roads that are not used by anybody except people using the property; farmers crossing from one side to the other. We have had a very few accidents; I am personally familiar with the facts relating to those accidents (T. 4796–4806). The last accident we had in which anybody was killed occurred in September 1922. It was Sunday afternoon about 2:45, and our east-bound train was going to the beach. There were three colored men in an open touring car coming from Baltimore. Our fireman was on the seat ringing the bell, and we also had a flagman, very large colored man, at the crossing waving his flag; but those three colored men were coming at a very high rate of speed, and they paid no attention to the engine whistle, the bell, or the flagman. They tried to beat the train across. Just about the time the engine got on the crossing this automobile crashed into the engine. The operator of the automobile tried to turn and go along parallel with the engine, and at that point we have a station with a platform about 4 feet high, and the engine crushed this automobile in between the engine and that station platform; and all three of the niggers were killed and burned up. It set fire to the train and to the station. We, of course, were entirely blameless in this accident and we never spent a cent on it. We have had no other accidents except 2 or 3 minor ones, where people ran into the train when it was about stopped and so was the automobile. No damage done or no one hurt.

We have never had any complaints from any of our firemen account their having to hand-fire the locomotive on our road. A fireman's duty on these highway crossings is to keep a look-out. If they fail to do this and are disciplined. I administer the discipline.

1334 I have never had to discipline for such failure to keep such look-out; we reduce our speed to 6 miles an hour across crossings. Our firemen have never requested mechanical

stokers on any of our locomotives. I would like to add, in my opinion, I cannot see where the power reverse gears or stokers would be of any advantage to us or any economy, because our engines are light, and the reverse gear of our engines is all light and well-balanced, and a man of ordinary strength can reverse them with one hand. We have never had anyone hurt or injured in any way by reversing an engine, and the same applies to the stokers. The engines and trains are light and the runs short. I cannot see the need, the advantage, or the economy of the stoker. By the time we would save enough in fuel consumption to pay for a stoker it would be worn out.

CROSS-EXAMINATION

By Mr. McLAUGHLIN:

"Q. Your statement that you consider power reverse necessary on the trunk lines was made, I take it, from your knowledge and experience of the mechanism that the reverse lever has to move on the larger engine. Is that right?

"A. That is my presumption, yes; that they are much heavier, and from my conversation with other men that work on the big railroads, I take it that the reverse gear could not well be handled by hand."

A. R. YARBOROUGH, defendants' witness, testified:

DIRECT EXAMINATION

In this proceeding I represent the Alabama Central Railroad Company, the Winifrede Railroad Company, and the Strouds Creek & Muddlety Railroad. I have a statement I wanted to make in connection with their physical condition, their financial condition, and outlook for the future of their continuance in operation.

1335 "Ex. ROGERS. Are you familiar with the number and type of locomotives that these roads have, or not?

"WITNESS. I only know the types of locomotives they use.

"Ex. ROGERS. I take it that the type of locomotive is about such as we have found on our short lines?

"WITNESS. Yes, sir.

"Mr. STEVENSON. Mr. Examiner, so that I will not interrupt, I would like to say that any projecting into the future and prophesying as to the future prospects of the roads is hardly proper in the record because that is just anybody's guess and tomorrow may be entirely different from today.

"Ex. ROGERS. We will have to meet that when we come to it. I rather understood from Mr. Yarborough that some of these had been mining roads and the mines were worked out, and so forth.

"Mr. STEVENSON. Opinions as to the future of the roads are hardly permissible."

(The record was made to show that the Alabama Central Railroad was no. 2 on exhibit no. 39. Attention was also called to the fact that an error had been made regarding the weight on drivers of this road's locomotives when the information was given to Mr. Miller's association.)

We have two Alabama Centrals, one Railway, the other Railroad. This is the railroad company. The weight on drivers of our locomotive is shown to be 100,000 pounds. The correct weight is 60,000 pounds.

I entered the service of the Chesapeake & Ohio Railroad Company on June 1, 1898, remaining until March 15, 1918, in various capacities in the transportation and traffic departments, leaving to go to the Ohio Central Lines as assistant to superintendent of freight transportation, headquarters—Charleston, West Va.

Leaving the Ohio Central on February 1, 1920, I became traffic manager of the Kanawah Coal Operators' Association, leaving that association November 1, 1927, to enter the private business of handling traffic and other matters for short-line railroads.

1336 I also practice before the Interstate Commerce Commission and testify as a rate analyst in various cases with other practitioners.

As to the Alabama Central Railroad: It connects with three trunk line railroads, namely Illinois Central, the Southern, and the Frisco, at Jasper. It is approximately 16½ miles long. It was first built as a lumber line about 26 years ago; ten years ago the lumber was exhausted. That railroad has coal mines at the extreme end of the line. Under normal conditions those coal companies produced approximately 5 cars of coal a day up until a year ago but, due to various conditions, the coal tonnage has fallen to an average of 2 cars a week. We are now operating on that line one train, round trip, per week. It has 17 crossings; one State highway crossing. Our ruling grade against the load, which is within five miles of Jasper, is approximately 2 percent. At no time, due to physical condition of the railroad, do we operate our trains in excess of 10 miles per hour.

At practically all the crossings, and particularly the State highway crossing, the crossing is visible from both sides of the cab a distance of over 600 feet in both directions, and in very many instances, I am told, our conductor precedes the engine and flags if we have loads—loaded train.

The future of the coal industry on that railroad, I might say, is questionable, due to the fact that the freight rates are so constructed that the mines that are operating on that railroad, and which are operating approximately one day a week, are forced to pay an arbitrary over the district rate.

The ever-encroaching use of electricity, oil, and gas, which is

1337 being piped into practically all the places in that territory, has taken the place of coal, especially the kind of coal that is produced at these mines, which has been used largely for domestic

purposes, and, added to that, the highway which runs practically parallel the whole distance of this railroad, has taken away all of its less-than-carload freight or merchandise freight.

In fact, we handle about 10 cars a year of fertilizer other than coal tonnage.

The Alabama Central Railroad's financial condition is precarious and, agreeing with the witness that preceded me as to the statement concerning the installation of power reverse gear or a stoker upon the type of locomotive now used by the Alabama Central, it would take years for us to pay for it—in fact, those mechanical devices would be worn out before we could ever secure sufficient money to pay for them. The railroad, in fact, has not the money to pay all of its employees at the present time.

We have only two men working on the track for a distance of 16½ miles. We have 6 men to operate the entire railroad.

The Strouds Creek & Muddlety Railroad is a line approximately 10 miles long extending from Allingdale, West Va., where it connects with the Baltimore & Ohio Railroad, to Delphi, West Va.

Its ruling grade is 3½ percent against the empty. It operates a Shay locomotive which was built by the Lima Locomotive Company. It has one crossing, which is a State highway.

Our maximum speed is 15 miles per hour. On approaching this crossing from either side the train stops and the fireman or engineer or conductor flags.

We operate a passenger service on that line, which is a second-handed Mack truck that has flanged wheels, and we carried the mail and some 120 passengers last year, most of them school children.

1338 That railroad serves 2 coal mines which have in the last year produced and shipped approximately 15 cars of coal.

Prior to 1925 the same mines produced 20 cars of coal a day.

One of the tipples has about rotted down and I do not think it will ever be operated again.

There is also a graded highway that traverses this railroad for a distance of 7½ miles.

We have no local freight to speak of and handle very little merchandise freight, which is mostly carload, consisting of such hay that may be consigned to Delphi, or lumber.

The net railway operating income deficit for the Strouds Creek & Muddlety for the year of 1930 was $12,619.47.

Winifrede Railroad: The net railway operating income, which is a deficit for the year 1930, was $2,547.30.

On account of no tonnage that railroad practically ceased operation for the years 1930, 1929, and part of 1928, until February of 1931, when the coal mines which had shut down on the line were leased to a new corporation. That corporation promises to ship some coal this year. So far they have shipped about 45 cars.

The railroad is 6.75 miles of main line and has one state highway crossing.

The maximum speed of the train which is run, when there is any business—sometimes the crew does not go out for three weeks—the train approaches this crossing and stops and the fireman or the conductor will flag while the train is passing.

They have one locomotive, built by the Baltimore Locomotive Works; it is a 2–8–0 type.

This particular crossing is visible for at least 500 feet from the south side and 250 feet from the north side.

There is no passenger traffic on this railroad.

1339 There is no traffic other than that the coal company may supply as going to the coal company in carload lots.

There is a county road paralleling the railroad its entire length (T. 4806–4816).

CROSS-EXAMINATION

The operating deficits are carried on the books as accounts payable at some time for taxes, supplies, wages, legal expenses, and other things. The deficit of $12,000 for 1930—about half of that was for ties that went into the railroad that have not been paid for yet, having been purchased from a lumber company along the line. That deficit is an indication of the condition of that road from 1931 to date. In fact, the condition from 1931 to present on all three of these lines is worse than it was in 1930, except the promise that the Winifrede will run. In regard to the Strouds Creek & Muddlety Railroad, the one with the $12,000 deficit for 1930, it had a still greater deficit for 1931, because in that year we put this locomotive in shape for general overhauling and remove its jacket. At least that is my understanding. That road had a hold-over deficit for 1929 of $1,742.96. For 1928 it was $260.81. The deficit for the year 1927 was $7,254.09. The $7,000 odd deficit is not included in the $12,000. They allow the railroad to run down to such an extent that it is almost impossible to operate it and then they will go out and buy on credit such materials as they need to put it back in shape. That is the reason you find every four or five years when you have to retie the railroad and put new bridge stringers where necessary you have large deficits. Even with this accumulating deficit, the railroad is able to go out and buy these supplies on credit. I don't know how but they have been able to do so.

As to whether this road is the child of another industry—it is owned by the Tioga Lumber Company which is a land-holding company.

1340 [File endorsement omitted.]

It operated a lumber mill at Tioga for years which was sold to the Birch Valley Lumber Company about 10 years ago. The Tioga Lumber Company also owns in fee about 13,000 acres of land which is supposed to be underlaid with a fairly good

grade of coal. That coal has been mined in the past but in the last year or two the high cost of production of this coal, due to its thin vein, and the parting in the seam, it is almost impossible to market that coal at a profit.

(Here the 1928 deficit is repeated—this time as $360.81.)

They paid the $7,000 deficit. I don't know who did it, personally. Probably they made money in 1928 to pay it off. That is the only way I can account for it. It is a deficit for the year of $361.81 as taken from the annual reports required to be kept by the Commission. I think they carry their deficits from one year to another.

"By Mr. STEVENSON:

"Q. To clear that up, in 1928 did the road make enough money to pay off the $7,000 deficit of the year before and just leave an operating deficit of $300?

"A. Probably so. I don't know whether they did or not. I don't know where they got their money to pay it. The only thing I know is that the annual reports and the accounts are kept in accordance with the Commission's instructions and orders. I do not know whether that is a cumulative deficit or not. All I know is that in 1927 they had a $7,000-odd deficit. In 1928, a $360.81 deficit. If they took in enough money during that year to pay off the $7,000 and meet all the operating expenses and everything else during that time and only had at the end of 1928 a deficit for the two years of $360 I suppose that is the total deficit. I can only take the reports."

These roads have mechanical fire doors. The Alabama Central made application to the Commission to ask them not to require it, but they had to go out and borrow the money to put it on.

1341 (As directed, certain information in connection with complainants' exhibit no. 13, containing a number of T-form accident reports concerning data as to whether engines in accident were equipped with hand reverse or power, covering all but the Louisiana & Arkansas, identified and received as "Defendants' Exhibit No. 49, Smith, Counsel.")

J. H. DALZELL, defendants' witness, testified:

DIRECT EXAMINATION

I am 45 years of age and reside at Los Angeles, Calif. I am a locomotive engineer, employed for the last 26 years by the Union Pacific Railroad, Los Angeles and Salt Lake Unit, 21 years of which time I spent as an engineer; remainder of the time as a fireman. Half of my experience has been with hand reverse gears. It has been seven years since I operated engines equipped with hand reverse gears in regular service, since which time I have operated engine so equipped on only one trip, about three years ago. During the time I was operating hand reverse gear engines I never sustained any injury due to such operation, nor did I ever see a fireman or engineer

injured operating the hand reverse lever. During such time there was only one occasion that I can remember that I was unable to operate the hand reverse lever. It was a new engine I had taken out of the shop to break in. When I found I could not operate the reverse lever, I had the switch engine take me back to the roundhouse, about half a mile. I spent some time in the service of breaking in engines out of the roundhouse. I did not undergo any undue fatigue in operating these engines equipped with hand reverse gears, nor did I have any difficulty in maintaining a fixed poise of cut-off.

For the past seven years I have had a regular run in freight service, operating between Los Angeles and Yermo, Calif., during which time I have operated power reverse geared engines. In oper-
1342 ating engines so equipped, I have not always been able to maintain a fixed point of cut-off; they vary sometimes. That is what is usually referred to as creeping (T. 4816–4826).

I have been in an accident where the power reverse contributed to the accident, February 2, 1917, between San Bernardino and Victorville, when I was in helper service on passenger and freight trains. It was a mountain grade, ascending from San Bernardino up to the summit through Cajon Pass; double track between San Bernardino and the summit.

From the time I left San Bernardino on this occasion, I helped a passenger freight to the summit and doubleheaded down the hill to Victorville. I was released there for 4 or 5 hours and then called to help a freight train back to the summit from Victorville. After reaching the summit, we cut off there and were headed in there on the passing track and after third no. 21, a passenger train, went by, we left the summit on a yellow block 16 minutes ahead of fourth no. 21. My engine was between two passenger trains. From the summit to Cajon Pass the grade is descending 152 feet to the mile; from Cajon Pass to San Bernardino it is 116 feet to the mile. I got down approximately 5 miles from the summit when I heard a noise on the right side of the engine. I looked at my air gauge and saw the pressure going back rapidly. I immediately set both brake valves and reversed the engine, which was equipped with power reverse gear, Ragonnet type. When I set the air and reversed the engine, it began to slow up immediately and I told the fireman to get his flag equipment and go back and flag fourth no. 21, while I got steam to working in the power reverse. I lit my torch—it was dark, around 9:15 or 9:20 at night—and got a nut, probably an inch nut, I carried in my tool box, jumped down on the ground when the engine slowed to about 3 or 4 miles per hour, walking along beside her for about
1343 25 or 30 feet, waiting for her to stop. I intended putting this nut under one of the drivers to block her as soon as she came to a stop. After I had walked about 25 or 30 feet the engine reversed herself, moving forward with a lunge as though she had been given steam. The fireman was just coming down the gangway with his flagging equipment; he immediately turned around and let me up in

the gangway—I got back with a little difficulty—I told him to open up both steam valves to the power reverse gear, while I set up the tender brake, which I tightened up as tight as I could get it with a large wrench so I could get more of a purchase on it, and as soon as I got through with that I stepped into the cab, and the fireman was up on top of the boiler, out in front of the cab, to open up the valve at the fountain. When I stepped in there he had been trying to open the valve, and he hollered to me and asked me to hand him a wrench. I handed him a stil'son wrench and saw him open the valve. I opened up the intermediate valve to this power reverse and felt the pipe which was cold. I moved the operating lever to the power reverse a few times but got no response. I then went out on the running board and on top of the boiler and tried the fountain valve and found that it was open. I thought probably the fireman had made a mistake and got the wrong valve. I came down and got in the cab; I moved the operating lever two or three more times without any response—I mean the operating lever for the power reverse gear. I saw the fireman lying down on the running board on his stomach when I got down off the top of the boiler, and he came in the cab right after I did and he told me that he had closed the air valve to the power reverse gear.

"Q. Do you know what that was done for?

"A. Well, I don't know, only that I thought perhaps he thought the steam was escaping clear through into the main reservoir or into the air pipes.

1044 "Q. By closing that that would prevent it from escaping back into the cylinders?—or into the air reservoir.

"A. The air pipes; yes, sir. I suppose he did not know whether there were check valves in those pipes to prevent anything like that, and he closed the air valve to the power reverse."

The engine was going so rapidly then that I expected her to turn over every second. She was rolling about and there was not anything else we could do in order to stop her, so I told the fireman that we better get back on the rear end of the tank. That is the only safe place we could be.

We crawled back over the tank and we were pretty nearly thrown off in going back there. The tank was rolling bad. I got on the back of the tank first and he did not show up right away. I thought perhaps he had been thrown off. So I stepped up one step to look up on the top of the tank, and I saw his head and shoulders sticking out of the water tank, the manhole. I stepped back down on the beam of the back end of the tank and in just a few seconds he crawled down there with me. He immediately got right down on the left back tank step. Just then we were striking a pretty sharp curve and a curve that I could see across for quite a ways. I leaned out over him and was looking for the tail lights of third no. 21. We had already run two red blocks, and just as we hit this curve I saw the engine start to turn over, so I stepped back to the

center of the beam at the back of the tank right directly over the draw bar, and I do not remember anything more until I got up—I was knocked out, I do not know for how long, some time, probably two or three minutes I should judge—the engine was still blowing off steam. The reason I think I was not knocked out very long was that it did not take the engine long to die.

It is my understanding—I heard afterward—a rail went right through the front flue sheet and the back flue sheet into the boiler and the fire box.

1345 As soon as the engine quit exhausting steam, I worked my way into the cab and got a couple of fusees, which were all wet, out of the seat box—I was walking around in oil and hot water up to my knees, almost—and I started back flagging. I walked back nearly half a mile to the next block signal. I was not sure whether the block signal would be red or not on account of the engine turning over on the east-bound main line and clearing the west-bound. There was no damage that I could see to the west-bound track when I went back; only a pair of tank trucks were straddled on the rails. When I got there to the block signal I found it was red, just then fourth no. 21, a passenger train, showed up, and I flagged them, and I was just about ready to drop when they put me in the baggage car. I had my right elbow broken and had contusions on the back of my neck and I was cut over the top of the head. They thought for four or five days that my neck was broken.

The fireman was killed instantly. It looked like he was thrown off and got caught in one of the tank trucks. He was laying right under one of these tank trucks; he had been dragged along quite a ways.

I didn't determine what started it. It sounded like a pipe broke that we lost the air. It was on the right side of the engine and after the wreck everything was torn off the right side of the engine and it could not be located what it was.

I was confined to hospital a little over five months.

"Q. When you were walking along the side of the engine you said that the engine gave a sudden lurch forward and that was the reason you got back on the engine; at least, that was when you got back on the engine. And the engine reversed itself. Can you explain what did happen or how it happened, from your knowledge and experience with these reverse gears?

1346 WITNESS. If the piston rod packing would happen to be leaking on the power reverse gears, it would let the pressure out of the front end of the reverse cylinder and the weights of the link blocks would naturally drop to the bottom of the links when the engine was in motion, throwing the engine in a forward motion."

I had not had any trouble with that gear prior to this. If the packing was leaking, I wouldn't have known it unless I just happened to be up close around it and heard it. That is what makes it creep—the packing leaking. I could not say she was creeping on

that trip. I don't know why I could not get steam into her. She was supposed to be equipped for steam operation (T. 4826–4836).

"By Mr. SMITH:

"Q. You stated that when you first reversed the gear your air was leaking off. You said you looked at the gauge and found that you were losing your air, didn't you?

"A. Yes, sir.

"Q. Would the leaking off of that air have anything to do with the engine reversing itself?

"A. Yes, sir.

"Q. Just state how that might have accounted for the engine reversing itself after you had gotten off?

"A. If it was one of the main reservoir pipes that broke the air is bound to go back the same way that it went in there, which would let all the air out of the power reverse gear."

Power reverse gears on engines equipped with them—sometimes the engines creep and that causes the engine to burn considerably more fuel. You do not maintain an even cut-off when an engine is creeping.

"Examiner ROGERS. Have you kept any record or run any test or anything like that to determine it?

"WITNESS. Yes, sir.

1347 "By Mr. SMITH:

"Q. What was the means by which you effected the slowing up of the engine to the rate of speed of three or four miles an hour? Would you mind explaining that a little more in detail?

"Ex. ROGERS. He said he reversed her and applied the air, as I recall it.

"Mr. SMITH. I understood, also, that he applied the air brake as well as reversing it. I thought perhaps he might also have used the steam. I would like if he would explain that a little bit more. Did you work the steam, also, in attempting to slow down the engine?

"A. No. I just reversed the engine and had the brakes set.

"Q. Mr. Dalzell, had this engine been equipped with a hand reverse gear, state whether or not you could have stopped the engine.

"A. Yes; I could have. I did not fail to take advantage of any means by which I could have stopped her under the circumstances.

WITNESS (continuing). That engine, A. L. A. & S. L. no. 3703, was put through the shop after that accident. I have run her several trips since then. She still has power reverse gear.

"At the time of the accident I was operating between through passenger trains. As we were progressing down this grade we passed two red block signals which indicated that we were in the same block as this passenger train that was ahead of us. The distances between blocks in that territory was about a mile and a half.

"I have been handling power reverse gear known as screw type for the last five or six years. It is power reverse gear operated by a

screw known as the Precision gear. I can reverse an engine with that type of power reverse gear as quickly as I can with a hand reverse gear.

1348 "The only trouble I have had with power reverse gears is creeping. I have operated the Precision gear (screw reverse), the Alco, and Ragonett."

(Ex. Rogers suggested that an accident investigation report on this accident be submitted.)

By Mr. SMITH:

"Q. Are there times when in operating the power reverse gear hand lever it does not take effect immediately and you have to do it over again. I will admit that is leading him, but he has not mentioned that, and I wish to direct his attention to it."

(Question objected to and objection overruled.)

"A. Yes, sir. I have had that experience several times, but only with the Ragonett type."

I have experienced creeping with the Ragonett and Precision power reverse gears. At present, we generally use the Precision type in our service.

I don't remember exactly how much I was compensated by the railroad for my injuries. About $800 or $900; also they paid the hospital bill.

(Witness stated he did not know whether any compensation was made for fireman's death and leave was given to supply that information.)

JOHN H. DALZELL

CROSS-EXAMINATION

For the past seven years, during which time I have been in freight and passenger service, with the exception of one trip, all the engines I have operated were equipped with power reverse. I have had experience on a number of different runs and different classes of runs. In that time I operated three cylinder type of engines, the 8800's, and the Santa Fe type, or 5500's. I do not know the weights on the drivers. All the engines generally used on our division today are power reversed. This has been the case for a number of years.

1349 Taking the last 15 years, we have had more and more power reverse gears. No new engine which we have had built, coming to our territory, has been equipped with manual reverse.

In my experience in breaking in engines new out of the shop, equipped with manual reverse, I had one case when I could not reverse the engine. All manually reversed engines are difficult to reverse when they come out of the shop. I have had other cases where the gear was very difficult to reverse, but I did get them over.

As to whether in my experience as a engineer I have found after an engine is broken in, there are other causes which make the manually reversed engine hard to handle: I guess working in water—getting dry valves. That is about all I know of.

They are harder to reverse and handle if they have the equalizing spring out of adjustment. Also in local switching, generally, when you go to throw the lever over and have steam in the cylinders, she is hard to handle.

"Q. You find that when you have dry valves out on the road and go to hook up the engine there is quite a pull on the Johnson bar when you take hold of her and unlatch her, due to dry valves?

"A. I don't do that. I usually ease off on the throttle and the lever is easier to handle. It is just to make it easier in handling the lever; if I did not do that the lever might give enough jerk to throw me."

In the breaking-in service, there are always some engines which are power reversed. I am always able to get them over by using power reverse—some with a little difficulty. The Precision gear works pretty stiff, sometimes. It is harder to operate than any of them (T. 4836–4846).

1350 "Q. Isn't that because you are trying to hurry the wheel around? If you let it take its time it does the work, doesn't it?

"A. No. You don't have to hurry. You can't hurry some of them. Some of them you can't hardly move.

"Q. Do you understand the wheel of the precision gear? All that does is to turn a worm, which operates the valve?

"A. Yes, sir.

"Q. You don't move any of the motion with your own effort in turning that wheel, do you?

"A. No, sir.

"Ex. Rogers. Aren't there some toggle joints between this wheel and the gear itself, this worm?

"Witness. You mean the universal joint?

"Ex. Rogers. Yes.

"Witness. Yes.

"Ex. Rogers. If those wear and get out of alignment, does that add to this difficulty of operating it, making it harder to turn?

"Witness. I could not say.

"Ex. Rogers. Do you know what it is that does make it hard to turn?

"Witness. The gear is just put up too snug, is all that I can figure out. When an engine has just been out of a shop everything is tight on her.

"Witness. This takes place only when they are just out of the shop. In four or five trips the engine handles pretty good."

It was just recently that the Ragonett did not take effect when I moved the operating lever in the cab. I guess it was the first type of

Ragonett that came out; first type I ever operated; had it since 1912. I don't know of operating any latter type of Ragonett's. The Alco is the only power reverse that I have operated recently that has the operating lever to the power gear. On this Ragonett you had
1351 to keep on moving it a little further before you get any response. You could move it 4 or 5 notches on the quadrant and it would not respond at all to that. You would move her probably one or two more notches and she would jump up 7 or 8 notches. I did not examine the gear to see what the difficulty was, but I reported it when I got in. I did not get this engine afterward, but I had had it before. She had been acting that way for some time—I could not say how long.

I should think lost motion on the valve mechanism or the reach rod or any of the bearings of the power reverse would have a tendency to cause that jumping action.

I could not say just how many times I have reported any power reverse on my daily work sheet in the last year. About on an average of once out of five or six trips. I make ten or eleven trips a month. Perhaps a couple of times a month. I could not say positively how many times I have reported this month. It is nearly always for creeping. I can't remember the last time I reported the gear for creeping—not any particular trip. The only trouble I have had with them was for creeping.

I never discovered why I could not get the steam into the power reverse on the occasion of the accident.

We have steam connections on our present power reverse. They are kept in workable condition so that we can cut them in—I know, for I have tried it out. As a usual thing they do operate now. If I had been able to cut in the steam on the occasion of the accident I could have prevented the accident.

REDIRECT EXAMINATION

It would depend on the length of time I would have to spend in getting the steam cut in as to whether I could have prevented the accident. The way our engines are equipped today—the way they are connected up, we can cut them in in half a minute or less than that.
1352 I think with the present steam connections, in the circumstances that existed at the time of the accident, the engine would never have run away. I would have gotten the engine reversed and she would have stayed reversed.

So far as the cutting in of the steam is involved, there is a difference between the power reverse gears as they were then and the present time. The fountain or main valve to the steam connection to the power reverse is in a handy place now where you can get at it. Some of them have extension rods to them, clear up on top of the fountain and some of them are tapped in on the side of the

boiler in front of the engineer's seat. The difference is that it is easier now to get at the valves by which you cut the steam in. That is the only difference that I know of as between the power reverse gears as they were designed at the time of the accident and the present time, except that they maintain them in better condition than they did years ago.

On that engine in 1917 on that particular date I don't think I ever got the steam into the power reverse or I could have reversed her. If there was a blind gasket in the line somewhere, I never saw one. I don't know why I did not get the steam down to her even after I opened the valve.

The purpose of breaking these engines in is to get them free and running good so you will have no trouble with them when you get out on the road; just to get the bearings worn down so they will run good; to get the engine loosened up so it will operate easily and properly. It is not with respect to hand gears alone but other things.

"Q. You say you have had no difficulty with respect to dry valves in operating your engines. Is that correct? Did you make that statement or a statement to that effect?

1353 "A. I think I made a statement that if my valves were dry I did not move the lever until after I eased off on the throttle.

"Q. Counsel asked you if you did not have dry valves and did not release the steam if it would make it hard to reverse the gear and you said yes. I want to know what you do under these circumstances, whether you take the laborious way or whether you take some other way.

"A. I take the easiest way out, which is cutting down your steam pressure in your cylinders. You can operate the hand gear with a little greater ease.

"Q. You made the statement that this precision gear was harder to operate than any of them. What gears do you include among the statement "any of them"?

"A. What I meant by that was the precision gear, when it does work, it is really harder to get it over than any of the other gears, hand or powered."

I have never experienced any ill effect or undue fatigue from this hard handling, which counsel has referred to.

GEORGE E. STEARNS, defendants' witness, testified:

DIRECT EXAMINATION

I am 54 years of age and reside at North Platte, Nebr. I have been employed by the Union Pacific Railroad for 33 years; a little over 28 years of that time as a locomotive engineer. During such time I have had occasion to operate hand- and power-reversed engines. At present I am operating engines equipped with power

reverse gears; 2,800 and 7,000 class, I guess; Pacific and Mountain type.

I have operated engines equipped with hand reverse gears in freight service and about two years ago, in an emergency, I made a trip on a passenger between Grand Island and North Platte
1353 (T. 4846–4858). I never worked in the yard service much. I have worked on through freight; also local freight to which I was assigned three years.

I have never had an accident, nor have I seen an accident to anyone else due to operating engines equipped with hand reverse gears; nor have I ever experienced excessive fatigue from the operation of such hand reverse geared engines. By that I mean I never got so tired that I could not work every day; I have gotten tired; any man that will work on a local train 12 or 16 hours will get tired, but not that I had to be sent for anything like that. I don't know just how tired—that depends on the physical condition, but I never had to lay off for rest or anything like that; no extra strains. I do not believe I would be more tired operating an engine equipped with hand reverse gear 12 or 14 hours than one equipped with power reverse gear, for that length of time, in local service. In operating engines equipped with hand-reverse gears I had no difficulty in obtaining a fixed point of cut-off; at times when operating engines equipped with power reverse gears you would have difficulty in using the cut-off—in obtaining the cut-off. I would call it due to creeping, as it is generally called. If you have an engine that is creeping you cannot hold her to her cut-off and the engine works down and it burns more coal and water and she will come back and go down, tearing the fire to pieces all the time. Fuel consumption is greater.

I was the engineer in passenger service on passenger train first no. 20, engine no, 2866, from North Platte to Grand Island, at about 7:40 in the evening, October 24, 1923, when an accident occurred involving the use of the power reverse gear, when one man was killed instantly. The facts were as follows: The passenger engines are assigned to the passenger trains from Cheyenne to Omaha, and as this train arrives at North Platte the engine crews change
1355 and the outgoing engine crew takes charge of the engine as soon as it stops. We got this engine. We had work to do on the head end of the passenger train, and the switch engine had the car. As soon as the incoming engine cuts off the train they push this baggage or mail car onto the train, and the incoming engine goes down the main track a couple of hundred yards while the switch engine is doing this work. I took the engine, which was Pacific type, power reverse gear—Franklin Ragonett, I believe—down and spotted the engine in the clear of the house track. The maintenance men and helpers were doing their work of greasing the engine, screwing down dope cups; and the inspector was looking it over to see if there

were any defects. I took my oil can, got on the right side, and started to oil from the gangway and I oiled the right gangway around to the left driver on the opposite side, or the north side of the engine. By that time the switch engine had its work done; the inspector and the man that run around to one of the helpers supposed they were ready to go and was hollering "O.K., let us go." I got up on the left side of the engine and walked across the deck and got up on the seat box and took hold of the reverse lever, or the lever that controls the valve. I moved this from center to back motion down in the corner, backward, and this little fellow, named Newman, came around by the right side and hollers up that there is a man caught in the gear. I looked out with my head out of the cab and I saw the man standing in the position as if he were working. When he said he was caught in the gear I just released the lever to about the center or maybe past center in the forward motion, and then I looked, and this fellow had just fallen off backward. As he was standing over there this rocker arm shaft caught him under the jaw, pushing his head against the reservoir and it just ground
1356 him right up, and mashed his head. I didn't start just yet.

This was when the engine was in neutral. Before the engine moved I would have had to release my air and open the throttle and give the engine steam to move her. The movement of the power reverse lever was only one of a series of things you would have to do before the engine was ready to move. I rung the bell. I sounded three blasts of the whistle [I would do that]. I do not recall whether I did that with the same movement or not before I noticed this man caught in the gear. I think I did. When I spotted the engine up there I applied the air. It is straight air. It is the ruling of the company that it must be put on any engine standing still. I did that.

After the gear had been placed in position for reversal of the movement of the engine it would be necessary to open the throttle which would admit steam to the cylinders before the engine would move.

"Q. In your opinion, would this accident have been avoided if this engine had been equipped with hand-reverse gear?

"A. No, sir; I do not think so; it would not.

"Q. You say the accident would not have occurred?

"Ex. Rogers. Wait a minute.

"Mr. Smith. That is what he means.

"Ex. Rogers. You have asked the question.

"Mr. Smith. I will withdraw it if I may.

"Ex. Rogers. You cannot withdraw it. You have asked him and he answered it. I know he did not answer it in the way you wanted him to."

What he wants to know, Mr. Stearns, is if you had a hand reverse on this engine do you think this accident would have happened?
1357 "Witness. No, sir; it would not."

By Mr. SMITH:

"Q. Will you explain why you do not think the accident would have happened if you had been operating a hand-reverse gear?

"A. If I had a hand-reverse gear, I would have thrown this in a backward motion, and I would have felt the obstruction to the gear and stopped.

"Ex. ROGERS. How do you know you would?

"WITNESS. I could feel it with the lever.

"Ex. ROGERS. Did you ever feel such an obstruction that way?

"WITNESS. I have had obstructions, something binding the catch, and I would stop.

"Ex. ROGERS. What obstructions have you felt that way?

"WITNESS. Bolts or some nut, or something like that. A bolt would work out of a link block or something like that.

"WITNESS (continuing). The tumbling shaft caught him under his jaw bone [indicating], the reservoir here [indicating] and the tumbling shaft come up and crushed his head together. There is about a seven-inch clearance there now. The gear might have given his head about a two-inch squeeze coming up; two and one-half inches, possibly. I positively do believe that I could have felt the obstruction caused by squeezing the man's head that much."

You could not have felt such a slight obstruction with the power reverse, but with the hand reverse pushing back she would go harder than she should, and you would know that there would be something in there.

As to the difference in the action of the power and hand reverse gears: when you have a power reverse, if you set that valve, that piston is going to where that valve is to cut off. When the air takes effect in the cylinder she starts to move right away. I mean, as
1358 you set your valves or as the air takes hold she walks right back there like that [indicating] (T. 4858–4868). The lever which I have thrown would not indicate any obstruction. In operating a hand reverse gear in reversing—in putting the engine in back motion, generally, I take hold and move it over about like that [indicating], unless I would see that I was getting into something, when, of course, I would grab her. I do not think I would give her more of a jerk than if I were putting her ahead to the corner. I generally take hold of her and lift her right back.

By Mr. SMITH:

"Q. Can you just illustrate it by showing what you would do with a hand reverse gear and your engine was standing, as that was, with your hand? Just put it out and pull it back the way you do.

"A. I generally take hold of the lever and lift her back like that [indicating]. I would call the movement uniform; steady and not a jerk back.

"Ex. Rogers (objects to leading the witness) and continues. I make that point because I do not think that is the way the witness does it.

"Witness. That is the way I always take it. There is no excitement about nothing. I just take it and lift her over.

"Ex. Rogers. You do not get hold of that lever like you do your pipe when you are going to light it, do you?

"Witness. A fellow will grab it, of course.

"Ex. Rogers. When you start back with it you come back with a pull, don't you?

"Witness. With enough movement that I can get her back where I want her.

"Ex. Rogers. That is quite a little, is it not, to get her back into the back corner?

"Witness. Yes; but it is not so overly an exertion, as I see it.

1359 "Ex. Rogers. It is more of a jerk than it is to get her out of the front corner and pull her up toward the center, is it not?

"Witness. From center to back?

"Ex. Rogers. It takes more of a jerk from center to the back than it does from the front corner to the center.

"Witness. I would just reverse that if I was doing it; more of a task to get her out of center than if you got her out.

"Ex. Rogers. When you were standing?

"Witness. Yes; or moving, either.

"Ex. Rogers. The one thing I am particularly interested in in that connection is what previous experience have you had that leads you to believe that you could have felt an obstruction caused by this man's head being squeezed a couple of inches while you were operating a hand reverse lever?

"The Witness. If there is an obstruction in the gear, it can generally be felt when it comes to that point of the obstruction.

"Examiner Rogers. What do you usually do? Pull a little harder?

"The Witness. It depends how hard it comes up there. If it stops, you look around and investigate what is wrong.

"Examiner Rogers. If it is so hard you cannot pull it, then you investigate it?

"The Witness. Yes.

"Examiner Rogers. But suppose you got to a place where she just pulled a little hard, would you then quit right there and look around or would you give her a yank?

"A. I possibly might give her a yank. More than likely a man would look around.

"Examiner Rogers. It depends on how hard it pulled and it would depend upon what the obstruction was, wouldn't it?

"The Witness. It would; yes, sir."

By Mr. SMITH:

"Q. If you met with an obstruction under such circumstances where there were men working around the engine, what would you do?

"A. I would stop and find out. It might be a hand or foot or something in the gear. A man would naturally go down there and look around.

"Examiner ROGERS. Do you have any idea that anybody was liable to get killed down there when you reversed?

"The WITNESS. No, sir; I did not, but since that I have had it impressed on my mind.

"Examiner ROGERS. But at that time?

"The WITNESS. No, sir.

"Examiner ROGERS. You never thought of such a thing, did you?

"The WITNESS. No, sir."

I have had a little experience in operating the precision screw type of power reverse gear. For direct action and precision, it is much slower than the hand reverse gear. The precision gear creeps.

1360 I have run this engine no. 2866 since the accident right along. The same power reverse gear is still on it.

The man whose head was crushed also had his left shoulder broken I think. The accident cost us money. A report was made of the accident. The division superintendent investigated it.

(It was stated the investigation file would disclose whether any regulatory body investigated the accident.)

Witness repeating information concerning accident:

A man came around and told me there was somebody caught in the gear. I reversed the engine and I saw him fall back. When he came up there after I had got in the cab and they hollered "all right, let's go." I got up in there and just pulled that down and as this man walked around the engine he walked past this fellow standing there on this step over the guide, and he said, "There is a man caught", and I looked out like that [indicating], and I seen him, and I released that lever. I knew he was up there. I could not see his shoulders; about this part of the body [indicating]. He was standing in this position [indicating]. Then I moved the reverse lever and that released him and he fell back. Of my own knowledge, I did not know where he was caught at the time. I only saw his position of standing there. I could not tell he was caught until I released it; then I saw him fall over backward. Just as soon as he fell I jumped right on the ground, ran to him; picked him up in my arms and held him. I saw that this jaw [indicating] was broken and he had a big crush here [indicating]. I could not tell what the condition of his shoulder was until later on. Just observed like anyone would getting to him as first aid. I turned him over to the baggage man; was not there when his clothing was removed; as far as the shoulder injury I know only what I have been told.

1361 GEORGE E. STEARNS

CROSS-EXAMINATION

At the present time, I ring the bell before I reverse the engine. Engine 2866 was a Pacific type, 167,000 pounds; her cylinders were 25x28 inch, I believe. At present, but not at that time, our road has the requirement of putting a blue flag on the pilot of the engine when men are working. The flag must be down before we can reverse the engine (t., 4868–78).

We got our first power reverse about 1912, since which time our road has been equipping engines with power reverse in increasing numbers. I have been operating power reverse engines, almost exclusively, since 1920. All our engines operating at present are equipped with power reverse.

There are locomotives on our division in service not equipped with power reverse; the 400's in branch and some switching service; the 200's and 300's and some switch engines. Class of service would be about switching and the locals.

It has been a long time since I handled an engine equipped with manual reverse. Most of my experience was on lighter engines about train size. I think the 200's are 191,000 on the drivers. I think about 163,000 pounds is the heaviest engine we have now that is equipped with manual reverse. The 191,000-pound engines were originally equipped with manual reverse; some of them have been converted to power reverse and are used in switching service. Some of the power reversed engines work pretty stiff, but both the manual and power reversed engines have been arranged so it does not take very much strength to handle either. It doesn't make any difference to me which I operate on a local freight run. I take the engine assigned to me. There has been some improvement in the operation of the power reverse since we first got it. Just about two or
1362 three trips ago I had an engine I reported creeping. That is quite a rare case with us.

GEORGE E. STEARNS

REDIRECT EXAMINATION

At the time the man was killed in the accident the Union Pacific had no rule requiring that we ring the bell before we operated the reverse gear and threw it over as I did in that case.

When I said creeping was a "rare" thing I meant quite often. Prior to this accident, the book of rules of our line did not specify that we should ring the bell before opening the throttle. Now it is my common practice to tap my bell before making any preparation for moving, such as moving the reverse lever. I take particular pains to see it is done. It has been my practice ever since I have been working to tap my bell before moving the reverse lever.

As to whether from my engineering experience it would occur to me that when I pulled the reverse lever from the center of the corner the engine would immediately move; it depends on whether you have steam in the throttle or not.

Under the present rules under which I work that the blue flag must be down before I can move, possibly there might be a repetition of the accident on the part of the other fellow that is working if I ring the bell or anything and he didn't move; but I do not see how we could have another accident like that.

(Statement made, the name of the individual who was killed in the accident testified to by Mr. Stearns was Harley C. Bunnell.)

W. H. BAILEY, defendants' witness, testified:

DIRECT EXAMINATION

I am 58 years old and reside at Ogden, Utah. I have been employed as a locomotive engineer by the Union Pacific for the last 27 years, at present operating as helper in both freight and passenger service, in the eighth district of the western division of that line between Ogden, Utah, and Evanston, Wyo.

1363

I have had experience in operating hand reverse geared engines during the time our line had hand reverse gears and before the advent of the power reverse gears. The Union Pacific has at Ogden hand reverse geared engines that take a regular turn in and out of Ogden in passenger helper service only. In emergency extra service I get these engines possibly twice a month. I have never had an accident in connection with the operation of a hand reverse lever; nor have I ever seen a fireman or engineer injured from such operation. In operating these hand reverse geared engines I have had no difficulty in maintaining a fixed point of cut-off.

We average about 28 days a month in helper service, going out and back the same day, round-trip distance of the helper district being 126 miles. There is a double track over the entire helper district.

From Ogden to Wahsatch, 11 miles west of the east terminal, where we cut off, is upgrade. We operate on the left-hand track within about 4 miles of the top of the hill; the east-bound traffic moving over the left-hand track and the west-bound traffic comes down over the right-hand track.

The balance of the time, when I do not operate one of the hand reverse geared engines, I operate engines equipped with Alco power reverse. None of the engines I operate are equipped with Franklin Ragonett. At times I have difficulty in maintaining a fixed point of cut-off with the Alco, ordinarily referred to as "creeping."

The average running time on the helper trips is 7 hours and 15 or 20 minutes.

The operation of the engines equipped with hand reverse gears does not tire me any more than operating an engine equipped
1364 with power reverse gears; nor does the operation of either unduly fatigue me (T. 4878–4889).

I have some familiarity with the Precision screw-type gear—plenty in the short time, as follows: I was moving through a passing track and on a curve could not see ahead and the fireman did not look ahead as I thought he did, and my engine collided with a caboose. I never saw the caboose until I hit it; the first signal, a stop signal being a verbal and hand signal combined, I got was possibly half an engine length from the caboose. The flagman saw I was coming around the curve and he came up. I heard him holler and I looked ahead, and he got out far enough so that I could see him. At that time I was possibly 40 or 50 feet back from the caboose; engine moving about 8 miles an hour. To avoid colliding, I closed the throttle and got the straight air in one hand and tried to reverse her with the other; started to reverse with the screw reverse and was not able to reverse the engine prior to striking the caboose. If the engine had been equipped with a hand reverse gear, I would have been able to reverse the engine before the collision. No one was injured in this collision but the caboose was demolished. I was disciplined by five months out of service, the assigned reason for which was that I did not know that the track was clear. The fireman was off a little while; I don't know how long.

As to why I think I could have reversed a hand reverse gear engine, I just know I could. I have reversed the hand reverse geared engines with one hand and operated the brake valve at the same time many times.

I was connected with another accident involving power reverse gear about 4:15 p.m., January 16, 1929. The other accident occurred about the middle of November 1927, engine 7006; think I have operated it since that accident and it still is equipped with Alco power reverse gear. The engine in the second accident was no. 5089, 1365 [illegible] as a freight helper. I had helped a heavy freight train from Ogden to Wahsatch; I cut out at Wahsatch, turned on the wye, and was returning to Ogden light. I had proceeded down the hill about 11 miles when I heard the machinery break on the left side. I immediately applied the air and the engine began to slow down. I had gotten the engine down to about possibly 12 or 15 miles an hour and I looked at the air gauge and my air was going from both the main reservoir pressure and the train line as well, and I tried to reverse the engine and it would not respond. I went over on the left side to see if I could see what had happened and could not on account of steam and hot water coming from the side of the engine. We could not get our heads out of the gangway. The fireman became excited and started to knock the fire and I quieted him, figuring what to do.

I told the fireman to go to the nearest telephone booth, telling them something had happened and for them to take action immediately and I would ride the engine. He rode as close to a telephone booth as possible; I rode the engine down the hill and tried to get my steam cut into my reservoir and see if there was anything that I could do to get the engine stopped. I got no results from my efforts to cut in the steam and found out afterwards that I had twisted off the cotter key in the universal where the extension connects to the valve steam proper and the fountain. I did that when I was trying to cut in—when I was pulling hard on the valve, so hard that I twisted off the cotter key. I could not open the valve and this prevented the steam from coming through the valve (continuing details):

I kept feeling that valve and I could turn it in the open position. I could get no response from my reverse gear. I was traveling along at a good speed and went to look to see if I could get
1366 at the fountain; due to steam and hot water blowing over, I could not get in there. I even went to the smoke box and got down on the hand rail and I could not see the running board so didn't dare get down there. I returned to the cab and repeatedly tried the reverse gear and, as a last resort, I tied the whistle to the brake valve and got down on the bottom step preparatory to leaving the engine if the block was against me, showing me at the junction that the main track was occupied. If the track was occupied, the condition of the signal showing me there was nothing left to do but leave the engine, and I measured the speed as best I could and let loose. I found out afterward the main rod broke on the left side. The piece on the pin knocked off my no. 1 air pump, breaking a 2-inch discharge pipe from the pump, and I immediately lost my air from the main reservoir. There was nothing else that I might have done before I got off the engine to stop it or break it that I know of. I got off the engine going about 80 miles an hour and I guess maybe it temporarily blanked me; and I got up thinking something had happened and I had better investigate when I heard them hit half a mile down in the yard and I started to run. Some ranchers saw me in the air and the engine go; they came with a truck to pick me up; I was on my feet and they took me to where the engine hit the cars when she stopped. I found the cause of the block signal being set against me was because the switch crew had just crossed the main line and had the switch improperly set, and when the engine went down there she went into this open switch and went into the empty ore cars they had just placed there; they were heavy steel gondola cars and the engine split one of them entirely in too.

I had engine 5089 once after that on one trip and it was still equipped with power reverse gear (T. 4889–4899).

1367 My purpose in trying to reverse the engine as I went down hill was to accumulate back pressure on the good side of the engine as a brake to slow up or stop the engine going down the hill. If the engine had been equipped with hand-reverse gear, I would have been able to stop it on that descending grade.

I had another experience when I was unable to operate a power reverse gear aside from the two occasions I mentioned. In the case of my engine colliding with a caboose, I was unable to operate the power reverse gear only for lack of time. I had the power reverse gear freeze so that it damaged the drivers before I could get the train stopped. It froze three times on the trip.

I do not consider that either the hand reverse or power reverse creates an unsafe condition in service; but in my opinion, the hand-reverse is superior for there is less possibility for the engine so equipped to break down because there is less mechanism to break, and if I had a choice of which engine I would have break down with me in this particular case of mine I would have taken a hand-reverse, but for general operation, I would say either of them. If I were the superintendent of motive power of the Union Pacific and could decided whether to have hand or power gear put on our engines, I would put power reverse on them for the same reason that the company has done it, for the convenience and comfort it has afforded the engineers.

W. H. BAILEY

CROSS-EXAMINATION

In the accident where I hit the caboose, it was a light engine—no train attached and, in my opinion, if I had had a manual reverse bar, possibly I could not have avoided hitting the caboose, which was approximately 50 or 60 or 70 feet from me when I first got notice of it, but I would have done no damage. I do not know the weight of the engine on drivers.

1368 If I had had an Alco or other power reverse gear except the Precision which works with a screw, I am positive I could have avoided the accident.

(Information furnished engine 7006 weighed 230,200 pounds.)

At the time of the accident engine 7006 was equipped with the Young valve gear—piston. I have never reversed the Young valve gear on an engine of that size with a manually operated reverse lever. I don't know whether I could have done it on this occasion or not.

Engine no. 5089 weighs 247,000 pounds on drivers; it had the Young valve motion. (Mr. Burnett stated that this locomotive weighed 297,500 pounds on drivers.) We have never had manual reverse on those large engines; I have never seen that type of engine with a manual reverse on it, so from my experience I do not know

whether I could have handled her going down hill—had she been equipped with a Johnson bar.

When engaged in helper service, in going up the hill, we have an irregular grade going up there and we adjust our cut-off. We have about 25 miles of letup, as we call it, on the hill. It is just a water grade, heavy water grade, and we have a good deal of adjusting of our cut-off. In handling hand-reversed engines about twice a month, the engines are 148500's. I don't remember that I ever made a trip where I worked water going up one of those hills with the 148,000-pound engine.

Possibly I have had a drive [dry] valve with one of the engines when operating her but if I had it never interfered with operation because I knew what to do and immediately opened my lubricator and we have some of the best water in the world, and we have had very little of that experience. As to handling the lever while the valves are dry: there is seldom that I have to take hold with both hands to handle that lever when I shut off going into Echo and drop my engine down. Our water conditions are that way.

1369 As to whether I would handle the lever if I had dry valves, I don't know. I cannot recall that I have ever had to think of that (t. 4899–4909).

REDIRECT EXAMINATION

I think possibly in the past five years, perhaps on work trains, I have operated an engine weighing 191,000 pounds, on drivers, equipped with a Johnson bar.

As to the experience I have had, under any conditions, of using the reverse lever as a brake to help stop or control the engine: when I go down the hill there with a light engine—we handle those engines light—and some of the time the brakes do not hold. If we run across a flag we will give them a little sand and tip them over the center. That is a common occurrence.

The fact that I have not operated an engine of the weight of those engines, does not change my opinion that if they had been equipped with hand-reverse gears I could have reversed them.

RECROSS EXAMINATION

When I reversed the engine, equipped with the Johnson bar, going down the grade, I gave the engine a little sand and applied the air and then threw the lever in back motion; possibly, I never attempted to reverse an engine going down the hill in that way without using the air and sand. I don't remember using the reverse lever alone without the air and the sand. Our speed limit now is 45 miles. I would not reverse until after I had used the air and possibly got her down to maybe 20 miles an hour, as I wanted to go around the point a little slower.

GEORGE H. WARFEL, defendants' witness, testified:

DIRECT EXAMINATION

1370 I am 47 years of age and live at Omaha, Nebr.

I have had 26 (?) years continuous railroad experience with the Union Pacific, consisting of 10 years as laborer, maintainer, and signal supervisor; 15 years as assistant roadmaster, district roadmaster, and general roadmaster; and the past five years I have been assistant to the general manager, in charge of the safety work on the railroad and accident reporting to the Interstate Commerce Commission.

I have ridden locomotives very frequently during all of the period of service as signal supervisor and roadmaster.

My safety work has familiarized me with the statistics of the Interstate Commerce Commission pertaining to accidents and personal injuries. I have had and still have charge of the Union Pacific records on those subjects.

At present I am chairman of the steam railroad section of the National Safety Council; also chairman of the train-accident committee of the safety section of the A.R.A.

Under my direction, charts bearing upon the subject of accident frequency of enginemen, particularly engineers and firemen, with respect to reverse gears and other accidents, have been prepared.

I prepared this exhibit 53, my authority being the annual statistics of the Interstate Commerce Commission for the years 1925 to 1929, inclusive. It shows that the number of casualties occurring while operating reverse gear as compared with the total casualties to engineers and firemen is very small, and it gives the percentage that the reverse-gear casualties constitute of the whole number of casualties. The number of engineers and firemen killed and injured for these years as shown in this exhibit was abstracted and consolidated from table no. 55 in Interstate Commerce Commission Accident Bulletin 98 and preceding annual bulletins. I do not know what the Bureau of Locomotive figures are for the same year. These are the Bureau of Accident statistics figures. A casualty is an injury resulting in disability of more than three days in the ten days immediately following the accident. The 1930 figures were not available at the time this exhibit was prepared. They have just recently been published and are as follows: For 1930 the first table there, engineers, the number of engineers killed, 53. The number injured, 1,011. The number of reverse-gear casualties, killed, none; injured, 71. And the percent of reverse-gear casualties to the total, 6.6. For firemen, 1930, the number of firemen killed, 49; the number injured, 1,650. The number of firemen injured in reverse-gear casualties, 5; none killed. The percentage is 0.3.

Referring to Mr. Dalzell's testimony where the fireman was killed, that casualty would not appear in this tabulation as a reverse-gear

casualty. The line of the accident table, which is 6313 in table 73, covers casualties received operating reverse gear. It does not include casualties that may have subsequently resulted from behavior of the engine due to operation or failure of the reverse gear, such as the one Mr. Dalzell related.

The Bailey case, where a main rod broke and these other things followed, would be classed as a main rod accident, as far as the classification is concerned. These figures which I gave here are casualties to engineers and firemen, the men directly interested. The figures include all reverse-gear casualties whether from hand reverse or power reverse, and there is no segregation in the Interstate Commerce Commission statistics as between the two. The figures include both power-reverse and hand-reverse casualties. There are numerous casualties resulting in one way or another in connection with the power gear but not while operating the reverse lever that (do not) come under this classification and, hence, they are scattered broadcast through the Commission's other classifications. There is no means of ascertaining the number of these accidents except by examining the individual reports of each accident for each year. One would have to pull all the individual reports if the Commission would give him that authority from the files of the Commission in order to get it. It is not segregated in any place in the printed statistics. I do not find compilation of figures similar to these given on exhibit 53 in the statistics of the Interstate Commerce Commission in the form we have here. I did not pick out different headings and assemble them myself and label them here as reverse-gear casualties. They are labeled " Operating reverse gear ", in line no. 6316, in table 73, in each annual bulletin.

These figures show that from 1925 to 1929 the percent of reverse-gear casualties to engineers and firemen has progressively decreased. The table covers only class I railroads (rec. 4929–34).

(Discussion between the examiner and counsel for complainants brought out that the figures shown on exhibit 53 from the I.C.C. Bureau of Statistics Reports refer to the line and classification of accidents reported under which were classified and shown the copies of form T reports introduced in evidence by the complainants as exhibit 13 for the years 1929 and 1930, as to which the examiner has asked the carriers to segregate the reverse-gear accidents as between hand and power (rec. 4945).

(The paper previously marked for identification "Defendants' Exhibit No. 53, Witness Warfel" was received in evidence.)

Exhibit 54 was compiled by me from records kept in my office which were furnished me at the time the casualties took place or shortly thereafter and is correct to the best of knowledge and belief. It shows the total casualties to engineers and firemen reported to the Interstate Commerce Commission occurring on the Union Pacific system, years 1926 to 1930, inclusive; also showing the total number of casualties involving the operation of reverse gear occurring to

engineers and firemen in the same period. In that entire five-
1371 year period there was but one reverse-gear casualty occurring to any engineer or firemen on the Union Pacific system. That involved a hand-reverse gear engine and the loss of 8 days' time.

The last column covers the percentage of our locomotives still using hand-reverse gears in each of those years. In other words, 62 percent of our locomotives were hand-reversed gears in 1926 and 42 percent were still hand-reverse gear locomotives in 1930.

I secured the information as to the estimated cost to equip balance of engines with power-reverse gear, shown on the bottom, from the superintendent of motive power, Mr. Burnett, with his authority, and I understand he will testify that this is the estimated amount (T. 4910–4940). The data as to percentage of engines with hand-reverse gears was also secured from the mechanical department.

(Paper identified as Defendants' Exhibit No. 54, Witness Warfel, received in evidence—with understanding Mr. Burnett will cover item of cost.)

CROSS-EXAMINATION

Witness WARFEL: With respeect to exhibit 54, I have no information as to the mileage run by the locomotives which are hand-reversed and those which are power-reversed in any given year.

Washington, D.C., October 1, 1931

Statement made that in the Harley C. Bunnell case, the company paid $6,000 in settlement of claim; and in the Cajon case the survivors of Fireman Davis were paid $3,500, and property damage was $2,800.

J. W. BURNETT, defendants' witness, testified:

DIRECT EXAMINATION

1372 I am 41 years of age and reside at Omaha, Nebr.

I have had 25 years mechanical railroad experience, 18 years of which has been with the Union Pacific in a supervisory capacity. In 1913 I was promoted from machinist to roundhouse foreman, and, successively, to general roundhouse foreman in 1917, to district foreman in 1921, to master mechanic in 1922, to assistant superintendent of motive power and machinery in 1928, to superintendent of motive power and machinery of the Union Pacific Railroad in December that year, and in 1930 was made assistant general superintendent of motive power and machinery of the Union Pacific system with jurisdiction over the Union Pacific Railroad, which position I now hold.

In regard to Mr. Warfel's statement that I supplied him with estimated cost to equip the balance of the engines with power-reverse gear, covered by exhibit 54, there has been a change in the amount

of the estimate which was reduced from $333,000 to $318,000 due to vacating a number of locomotives in the original estimate. They were junked and cut up as scrap. The figure now is $318,597 (correction made in the record).

As roundhouse foreman and general roundhouse foreman I was in direct charge of locomotive repair forces and in personal contact with the work reported by enginemen and required to approve work reports made by enginemen in regard to the condition of locomotives operated by them in and out of the terminal under my jurisdiction.

As general roundhouse foreman and district foreman, I had jurisdiction over enginemen and was in personal contact with them. During this time I have never heard of any engineman being injured operating a hand reverse gear; nor did I receive any complaints from enginemen that the operation of hand reverse gears caused them undue fatigue or interfered with the safe operation of the locomotive.

1373 I have never heard of nor had a complaint from an engineman with respect to his having any difficulty in receiving signals when operating a locomotive equipped with hand-operated reverse gear.

New locomotives out of the shops at all points where I have had supervision, both hand- and power-operated reverse gears, have had the gears inspected and tested and engines broken in and gears made to operate freely before they were turned over to the enginemen for regular service.

In my 18 years of experience as supervisor, I have spent considerable time riding and operating locomotives equipped with hand-operated, as well as power-operated, reverse gears and I have never observed an engineman having difficulty operating a hand reverse gear; neither have I observed any engineman or heard of any complaints from enginemen as to any physical overexertion being required on his or their parts to operate a hand reverse gear. I have never observed an engineman having difficulty adjusting a hand-operated reverse gear to the proper cut-off while the engine was in motion. Have never had called to my attention or known of a hand-operated reverse gear jumping out of the quadrant and going to forward motion when engineer was endeavoring to adjust cut-off, which would place him in a hazardous position in the cab; nor heard of an engineman complaining as to the room in a cab of our locomotive (t. 4941–50).

I have never known of an engineman operating an engine, over which I had charge, receiving an injury as the result of operating either hand-operated or power reverse gear.

In my opinion the accident to Harley C. Bunnell would not have occurred if the engine had been equipped with hand reverse gear, because I was master mechanic at the time on the division, and while I did not directly investigate the case, I had supervision over

1374 those who did. Harley Bunnell was caught first by the shoul-

ders, and due to the pressure in the cylinder of the air reverse, the tumbling shaft slipped off his shoulders, catching his head, and striking it, and fracturing the skull. From my own experience in handling a reverse lever, both as an engineer, fireman, and a mechanic, I have frequently felt obstructions in the valve motion, which would indicate that the valve gear on the locomotive was not free, and I would stop my effort to reverse the engine. I feel if this engine had been equipped with a hand reverse lever, that engineer would have had such an indication in the cab, and would have stopped before the full stroke of the reverse lever was completed, and would have saved that boy's life.

1374a "Examiner ROGERS. Right on that point, if that is true, how does it come that you left the power reverse gear on that engine?

"The WITNESS. That engine is so designed that the fire box would have to be changed to provide clearance, if you would apply a hand-operated lever.

"Examiner ROGERS. Do you mean by that because of this item of expense, that you left the power reverse on the engine when it is liable to kill a man, as in this case?

"The WITNESS. That means that we took other measures to prevent a similar accident.

"Examiner ROGERS. Now, if that is true, then the fact that this accident happened, under those circumstances, and you have taken steps to prevent a recurrence, is that accident in your mind any reason for not applying power reverse gear to future equipment, and, if so, how does it come about?

"The WITNESS. I have no——"

(Addressing the reporter.) Please read the question.

(The pending question, as above recorded, was read by the reporter.)

"The WITNESS. I am not in a position to answer that question at this time about future equipment.

"Examiner ROGERS. The only reason, as I understand it, why this accident was brought in here was to indicate that the Commission should not require power reverse gear to be applied to other locomotives.

"Mr. SMITH. Of course, that is not the only purpose, Mr. Examiner, if I may interrupt.

"Examiner ROGERS. What is the other purpose?

"Mr. SMITH. One of the purposes is to show that accidents do occur with power reverse gears, perhaps not one similar to this——

"Examiner ROGERS. That is just the point I am asking the witness about. If by changing your operating rules, you have avoided the possibility of a recurrence, how does this accident prevent [present] any guide as to what we should do in the future?

1374b "The WITNESS. We have provided a means of avoiding it, if some employee does not violate our own rules.

"Examiner ROGERS. I take it, Mr. Burnett, that if you thought that there was a probability of another man being killed on that engine, because she had power reverse on her, you would not leave the engine run with power reverse?

"The WITNESS. I assume that you understand that we have numerous engines similarly equipped.

"Examiner ROGERS. But what would apply to one would apply to the others, I take it. As I said, I take it if you thought that the probability of men being killed, as this man was, by the continued operation of those engines with power reverse, that you would not operate them with power reverse. Is that not true?"

(A colloquy between Examiner Rogers and counsel ensued.)

"The WITNESS. I will answer the question.

"Examiner ROGERS. Read the question, Mr. Reporter."

(The pending question as above recorded, was read by the reporter as follows:

"Q. But what would apply to one would apply to the others, I take it. As I said, I take it if you thought that the probability of men being killed, as this man was, by the continued operation of those engines with power reverse, that you would not operate them with power reverse. Is that correct?)

"The WITNESS. I will say that we do not expect anyone to be killed or injured with any reverse lever. We do have the possibility of new or untrained employees working about locomotives that might violate our instructions and receive injury."

I was present at the hearings last spring when witnesses were introduced on behalf of the Union Pacific and heard the testimony in regard to other accidents in connection with power reverse gears.

1375 I also heard Mr. Dalzell's and Mr. Bailey's testimony. I do know of other instances in which accidents might have been avoided in connection with power reverse gears if the engine had been equipped with hand reverse gears. We have had cases where hostlers and others, in starting to move engines equipped with power reverse gears out of roundhouses, were governed by the position of the lever in the cab and would open the throttle anticipating that the engine would move backward, as indicated by the position of the reverse gear lever, on to the table, but, in fact, the engine would move forward due to the lever and the reverse gear cylinder failing to properly function, or function together, resulting in the engine striking and damaging roundhouse walls.

At Council Bluffs, Iowa, September 17, 1928, yard engine no. 1926 was placed in engine house for repairs. The hostler upon taking engine out of the house, placed lever in the cab in reverse and opened throttle, but, due to gear lever being disconnected, the gear remained in forward position and the engine started ahead striking partition, resulting in a property damage of $300. Had this engine been equipped with hand operated reverse gear, action of

the lever in the cab would have immediately indicated to this hostler that is was connected.

At Fremont, Nebr., September 23, 1930, steam pipe to air pump on locomotive no. 2240 broke, rendering air pump inoperative. In order to move this train, it was consolidated with another train pulled by a locomotive. Auxiliary steam line was turned into the air reverse gear for emergency use, and to help the engineer brake the locomotive. Due to the pump being inoperative, the engine did not carry any air pressure. (In answer to question, stated that he had not said he could not get the steam in the reverse gear in this one case.)

1376 Referring back to the Dalzell and Bailey cases: I have knowledge of both cases, as a result of investigation. Mr. Dalzell was operating a locomotive which had a blind gasket in the union, just above the cab floor inside the cab. The blind gasket entirely clogged the steam pipe. In the event that it became necessary to cut the steam in, the engineer would have to have disconnected the union and locate the blind gasket, and at that time it was understood by engineers operating those engines they would do that. I would estimate it would require an engineer ten minutes to do that job, and it would require more time to cut the gear in with steam than if the blind gasket was not there. It was on the instruction of the management that these blind gaskets were put in there, but it was a local arrangement, of which the supervisors of a minor capacity had knowledge (T. 4951–62).

The Omaha people did not know these blind gaskets were in there. As to the purpose for putting the blind gaskets in the pipe: In that particular territory they were bothered with cold weather in the winter and in summer with contamination and they have trouble maintaining the reverse gears; also trouble maintaining the valves between the reverse gear and the boiler due to the infrequent use of the valve, and they leak, this water or steam leak finally forming and causing condensation in the air reverse cylinder, resulting in damage and heavy maintenance cost, more than if they maintain the air reverse.

It is problematical whether the running away might have been avoided if there had been a blind gasket, for the reason that steam cut into a reverse gear frequently fails to furnish necessary power to operate the gear.

1377 (As to Mr. Stevenson's question of whether putting in the blind gasket in the steam line does not entirely defeat the purpose of having the steam connection into the power reverse, Mr. Rogers says it seems obvious to him that it defeats it, so far as quick action is concerned, but, of course, if you had 10 or 15 minutes (as Mr. Burnett put it) you could take the gasket out.)

In re the Bailey case: Mr. Bailey going down that hill was losing his air and reached up hurriedly to an extension handle that was directly connected with the fountain valve controlling the steam

pressure to the reverse gear, and in his anxiety to get it open quick he twisted off the cotter key that passes thru the universal joint connecting this extension handle to the fountain valve. The fountain valve was operative, had he been able to put the needed pressure on it to open it. It was opened directly after the accident. This little cotter key was not of sufficient strength. In this case he put enough pressure on it to twist off the cotter key and still could not open it.

As to whether this condition may frequently occur because of the fact that the use of the steam cut-in is so seldom availed of by the engineer or so seldom necessary. My experience has been this: That we have an intermediate valve in the steam line from the boiler to the reverse gear. Any that happens to the intermediate valve and the fountain valve in most cases leaks slightly. Corrosion, scale, and impurities in the water will leak by this first valve and frequently this foreign substance hardens around the valve and causes the valve to seize; and this happens and can happen in one trip.

"Q. May I ask if, when some accident occurs by which your air is drained off, and that is between this check valve and the valve chamber of the power reverse gear or in the valve
1378 chamber of the reverse gear, would that also let the steam drain off just the same as it let the air drain off?

"A. On some power reverse gears the steam is connected into a nipple, and both steam and air enter for a short distance thru the same pipe; some power reverse gears have a connection separate from the air line for the steam. With those gears equipped with the joint connection, a failure of the particular pipe that conveys both pressures, breaking would render the gear inoperative, either by air or steam.

"Q. If the breakage was in the cylinder of the reverse gear and permitted the air to drain off, what effect would it have if the steam was turned in?

"A. It would have the same effect. If the opening or defect was in any part of the valve or cylinder of the gear, it would have the same effect with steam as it would with the air."

(Witness continuing.)

Where they have a separate steam pipe and the air pipe was broken off at the reverse cylinder, the steam would drain off thru that air pipe. This would render the gear inoperative until the opening had been stopped. The intermediate valve is for the purpose of insuring against the possibility of water, which frequently leaks by the main valve, getting into the air-operated reverse cylinder. The fountain valve and intermediate valve are used once each thirty days in order that the mechanics may complete an inspection of them. Engineers are asked to, but not required to, frequently test the valves to know that they are in operating condition, but there is no hard and fast rule, because of the impracticability of keeping those valves in a good operating condition, inasmuch as they

are not used and scale and other substances accumulates around them.

1379 When the witness said if they had been arranged at that time as they are today, you would have had no trouble cutting them in, he referred to the absence of the blind gasket. There has been an extension handle applied which makes the valve more accessible. As to the steps taken to see the valves are maintained so that a man can open them without twisting the handle off: the valve bonnet is removed once each thirty days; we grind the seat, oil it, and replace it. The necessity for this exists because this valve is infrequently used, and any valve on a locomotive, no matter for what purpose applied, will become inoperative if it is not used frequently. By "frequent" I mean at least every trip the locomotive makes.

Returning to the accident at Fremont: The steam when turned in damaged the reverse-gear cylinder packing cups, and while making switching movements the engine collided with cars due to the engineer's inability to control the locomotive with the power reverse gear, resulting in damage to the extent of $3,014.78. Engineer Aita testified in this proceeding and stated, in his opinion, had the engine been equipped with a hand-operated reverse gear, he would have been able to stop the locomotive before striking those cars. I agree in his conclusion.

I have heard Mr. Bailey's testimony and am familiar with the accident thru the investigation and the files and it is my opinion that Mr. Bailey would have been able to prevent the accident had his engine been equipped with a hand-operated reverse gear. The property damage in connection with that accident was $2,885.

With respect to all these accidents to which I have referred, from my experience, the accidents would not have happened had the different engines been equipped with hand reverse gears.

1380 In the case of Mr. Bailey's, at Wahsatch, what the result would have been if he had reversed the engine and given her steam on the other side: Had the reverse gear functioned, I feel that he would have been able at least to stop the engine when he had it partially stopped with the air, before he lost it. I do not think there was danger of stripping her at that speed. He was going too slow.

In my opinion there is no hazard to the hand or power reverse gear, to the engineman or engineer operating the locomotive, but around roundhouses and engine terminals the power gear is not always as reliable, and frequently becomes inoperative, and there is a hazard to other employees, coal-chute attendant and men employees inside the roundhouse. I do not consider there is an unreasonable or undue hazard with either the power- or the hand-operated gear. I do consider there is an unnecessary hazard with the power reverse gear, in handling locomotives around terminals, by hostlers and others—not engineers. By that statement I do not admit en-

gines power reverse-geared are operating in violation of the law (prohibiting the operation of any locomotive in condition that it creates an unnecessary peril) but I do admit that to date no power reverse gear put on the market is reliable at all times.

My experience with the construction of power reverse and the expense of maintaining them follows: As a supervisor I had direct charge of repairs to locomotives equipped with five different types of power reverse gear—I have personally overhauled with my own hands all these different makes of gears, as follows: Ragonnet, Alco, Barco, Mellin, Precision, as well as the hand-operated reverse gear.

I am thoroly familiar with the construction, operation, and
1381 cost of maintenance of these different types of power reverse gears as compared with the hand-operated reverse gears, and have personal knowledge from actual experience that the power reverse gears require constant attention, develop numerous defects, and are expensive to maintain in operating condition, due to the fact that consideration must be given to the losses resulting from defective power reverse gears which render the gears ineffective for proper handling of the locomotives by enginemen and which, from our experience, result in excessive fuel consumption, due to inability to maintain a fixed point of cut-off with power reverse gears.

Enginemen are frequently confronted with the necessity of properly controlling the cut-off of locomotives on trains and with which we have experienced continually difficulties due to the fact that no power reverse gear has as yet been perfected to a point where it is positive and will not creep. This is not the case with hand-operated gears.

Power reverse gears are equipped with an auxiliary steam line to be used in case of an air failure which is supposed to enable the engineer to use the power reverse gear and the locomotive as a brake in an emergency resulting from the T. 4963–73) failure of the air. In such a case it is frequently not effective because either the engine cannot be reversed at all or, if reversed, it cannot be done quickly enough to avoid the possible accident.

Difficulty experienced during the winter months, when steam is turned into reverse-gear cylinders, due to moisture from the steam creeping and rendering the power reverse gear inoperative. During the summer months, condensation accumulates, filling reverse-gear cylinder with water, which also renders years [gears] inoperative for emergency use.

1382 This condensation will accumulate regardless of most any method you might follow to provide drain cocks, due to the solids in the water leaking by valves, and while this condition is not always present, it frequently occurs.

The hand operated reverse gear is always reliable and available to be used in conjunction with the locomotive as a means of controlling movement of the train in case of air failure or the breaking of air pipes which results in the loss of air on the locomotive.

The reason the Union Pacific purchased reverse gears and equipped previously hand reverse geared engines with them was a matter of convenience to enginemen. It was recognized, power reverse gears lessened the burden of engineers' work, to some extent, at least, and not for the reason they were more economical, efficient or rendered the locomotive more safe to operate than engines equipped with hand reverse gears.

The Union Pacific System lines have 673 locomotives still equipped with hand operated reverse gears and it is not our intention to equip these engines with power reverse gears for the reason that they are of small type, light capacity, used in branch line and local service, are 15 to 30 years old and many are of restricted utility, and due to their age and obsolescence will be scrapped within the course of a few years. (It was explained that the statement supplied Mr. Rogers at the previous hearing, covering Union Pacific requirements of 704 locomotives to be equipped was correct at the time but since the figures had been furnished, engines have been set aside and wrecked, vacated, and those engines were taken into account in the figures given to date.)

(Witness continuing.)

Due to the lingering illness and death of Mr. Jackson, our superintendent of motive power, I have had complete charge of our department for several months and for the purpose of this
1383 hearing, I took up the subject of curtailing expenditures from Mr. Jeffers, vice president in charge of operations. In the mechanical department during the year 1930, the reduction in materials consumed was $2,259,682 as compared with the year 1929, or $400,000 in excess of the reduction in labor (T. 4974–87). Any reduction that can be accomplished in material costs, either through conservation or judicious application or appurtenances, affords more money for labor.

There would be a natural decline in expenditures for labor and material, due to the fact that we have 35 percent of our locomotives out of service in serviceable condition, but we have reduced below the natural decline, especially in the material items. We are allowed so much money to operate the mechanical department, and every dime saved on material, we are allowed to spend for labor. The money is given to us not specifying whether it be spent on material or labor; by conserving that, we help the unemployment situation even though we spend it on equipment not needed for immediate service. We have conditioned several thousand cars to keep our shops working and from laying off men who are in reserve.

The ratio of material and labor on ordinary locomotive car repairs prior to the necessity of taking care of the unemployment situation would run about 60 percent labor and 40 percent (?) material. Through our efforts to reduce unemployment we have reversed those figures—about 60 percent labor and 40 percent material.

As a practical matter, hand reversed gears cannot be applied to our larger power or new engines as they are at present designed. Throughout the life of the power reverse gear we have recognized this inefficiency, but at the advent of the power reverse gear our designers provided for additional grate area in designing locomotive boilers, and the only way they could do that and limit the distance from the fire door to the flue sheet was by widening the fire-
1384 boxes, and on our modern locomotives our fire boxes are so wide there would be no room in the cab for the hand reverse lever.

The size of a locomotive has very little, if anything, to do with the labor in reversing an engine with a hand reverse gear. The modern valve motion, as applied to modern engines, in fact, reverses them much easier than the old type engine with the Stephenson link motion.

As to the force feed lubrication and the improvements which have rendered the present-day reverse gear easier to operate than in the old days: The improved lubrication to the locomotive, naturally makes the reversing of an engine much easier, but with the older engine the reverse lever had to lift the weight of the links plus the eccentric blades, and moved the position of the eccentric straps on the cams. The only thing with the modern valve motion which has to be accomplished by the reverse lever is to change the position of the link block, radius bar, and valves, which does not require the pull or pressure that the old link motion engine did.

On our road, the valves are not larger in diameter than they used to be. They are a little longer and have a longer travel, but the bearing area of the valve is the same.

The impracticability from the standpoint of room in the cab in applying hand reverse gear would control the purchase of new locomotives but it does not necessarily follow that that would control the putting on of gears to existing power. In a great many cases the equipping with power reverse for former hand reverse was to experiment as to the difference between the two gears; and at the request of engineer committees and even individual engineers, since it
1385 has always been our policy to cooperate with and solicit the goodwill of our enginemen. We have a highly polished exhibit engine which works in the union passenger station at Omaha, for show purposes, and recently, at the engineer's request, we applied a nickel-plated power reverse gear and that is the only power reverse gear I have applied in the past 12 to 14 months.

I find our engineers are divided—some ask for power reverse gears and others ask that they be not put on. The question of design has limited the application of a hand gear to the extent that we could not develop the tractive effort necessary on a locomotive and restrict the fire-box area, with the modern engine.

"Ex. ROGERS. You have applied 950 power reverse gears. On how many of those engines did you apply the power reverse gear because

of this condition in design, where you could not get the hand gear on?

"WITNESS. I would have to figure that up, but I would say that applies to all the engines which we have purchased since 1911, when the wide fire box was first recognized as a necessity in order to develop the economy desired from a locomotive boiler. We have not purchased any engines since 1911 that were not equipped with power reverse gear."

As to the statement showing classes of 4–8–2 passenger engines, all the same type and equipped with power reverse except one, that engine equipped with hand reverse was originally equipped with a Precision gear, and we changed the valve motion from Young to Caprodi, the Italian gear, and the power reverse gear cannot be used in connection with the Caprodi valve gear—for that reason we applied the hand gear back to that locomotive; those engines were bought in 1922. As to the possibility of being able to equip all of those engines with hand reverse gear; the hand gear on this
1386 particular engine, is of a multiple lever type, and instead of shifting valve motion, all it does is change the position of the cam. There are no weights or no pull involved. The lever in the cab is the old power reverse gear lever, and it is hooked up through a bell crank, and a long straight rod which changes the position of the cams in this gear.

The Pacific type of engines, 166,900 pounds, were purchased in the latter part of 1912. I would say the condition of the design had nothing to do with the application of power gear to these engines.

Of the switchers, Consolidation type, 191,100 pounds on drivers—30 equipped with hand and 50 with power levers. We applied those gears as a result of request made by local committees at different points, and I would not say that design had anything to do with that.

(It was made clear that the statement that the principal reason for applying the power gear was the question of clearance in the cab applied to the engines purchased of the large size.)

We have at present in the switching service, engines operated with hand reverse gears; also engines in that service now, but not originally, equipped with power reverse gears.

The reason for some being equipped with power and others not is due to the former statement of cooperation with engineers. They were requested for certain jobs and in certain yard service.

There have been no demands from engineers' organization to equip the balance of the switch engines with power reverse in the last year; or from the men that has reached me.

(Exhibits prepared under Mr. Burnett's supervision marked for identification "Exhibit No. 55, Witness Burnett.")

The figures appearing on exhibit no. 55 were obtained from time records by a statistician, the records indicating the daily
1387 expense to the different reverse gears by engine number, plus

the cost of overhauling the reverse gear, furnished by the time records of our machine shop, taken from the time cards as made out by the workman, plus the cost of material necessary for the repairs. These are records of our department and cover the year 1930; to the best of my knowledge and belief the figures are accurate.

(Above-mentioned document received in evidence marked "Exhibit No. 55, Witness Burnett.")

I could only make a guess as to the difference in the cost of power or hand reverse gear, new. Would say it would not be more than $400—perhaps not more than $300.

(Exhibit purporting to show some detail as to defects in hand and power reverse gear received in evidence marked "Exhibit No. 56, Witness Burnett.")

I requested a mechanical engineer to personally take from the engineers' work reports at Council Bluffs the information furnished in exhibit no. 56 and he compiled the figures and made the exhibit under my direction. In re this exhibit; while I confined this to one major engine terminal, my experience is to the effect that this same condition prevails at all major terminals on our railroad (T. 4988–5001). I did not examine all the work reports personally, but part of them. As to the first and third classified defects "piston packing" and "creeping", they are not two separate defects; it could be the same thing except they are separate reports. Those who reported creeping by the engine are not included in those reported in "piston packing" because of the number of reports turned in. Of that number during the month, 34 reported creeping and 63 reported defective piston packing.

Defective piston packing results in a loss of fuel and time to the extent that the packing is defective, and the reverse gear cylinder piston cannot be controlled as a result of the leakage by the defective packing and that results in creeping.

1388 As to whether the engineman could not report the piston packing leaking and the gear creeping on the same report: I would say that the engineer would not report an engine creeping and at the same time report the piston packing defective; that each one of these are separate arrivals of engines at the round-house. The creeping is just a condition. We instruct our engineers to report any information they have with regard to a defect; but the engineer does not know nor is he able to detect near all the defects in a power reverse gear; because there are hidden defects there. They know the piston packing is leaking because they hear it or see it as they inspect the engine. That is one of the defects in the open which the engineer can easily detect.

The effect of piston packing leaking on the operation of the gear is that the air, if it is leaking badly enough, will leak away from the forward side of the piston and cause the piston to go down, and it will move the valve, and then come back, which is called "creeping."

The rod packing has a very similar effect.

I cannot say positively as I did not personally compile the report, but it is my understanding that there was no duplication in this report.

The man who prepared exhibit no. 56 was instructed to take the work report made covering the condition of every locomotive that arrived at that terminal during that period of time, and list the defects as reported by the engineers.

Referring to the report "creeping", the report is brought about by an engineer who is dilatory in his work and does not take time to develop just what the defect is and he merely puts on his work report "reverse gear creeping." The receipt of such a report necessitates us going into the gear far enough to determine the
1389 cause of the report. Generally in the inspection, we have trouble in getting the modern engineer to report the actual defects, but not with the old-time engineer, who is pretty good.

The reverse gear cylinder is subjected to a push and pull of the valve motion of a locomotive, which results in the reverse gear casting, which includes the cylinder and the brackets working loose on the bracket which is provided on the boiler, and the gear will loosen; the engineman will see the gear moving and will report the reverse gear loose in the bracket in order to have it tightened up.

The five reports on "valve" means a defect in the reverse-gear control valve.

As to report on "gasket leaking"; there are three gaskets on the reverse gear; I do not know which one was leaking in this case. Two of the gaskets leaking would cause the reverse gear to creep, while the other one would only cause a loss of air.

"Bracket loose on boiler" is the reverse lever bracket in the cab. The bracket is made either of casting or sheet steel and is studded to the boiler, and through the service of the reverse gear the bracket will wear a little larger in the studs, and the nuts will become worn, and it requires a follow-up of the pressure under the nut to keep the bracket solid. The engineers notice the bracket vibrating on the boiler-head in the cab and it worries him. It does not appear in the operation of the reverse gear.

"Play in bushings" is lost motion through a natural wear and to a very slight extent interferes with the operation of the reverse gear.

"Gear works hard" requires no explanation.

The reverse-gear piston rod is connected with the reverse-gear crosshead, with the conventional type of tapered key, and this report covers the condition when the "key comes loose"
1390 in the hole. This may or may not interfere with the operation. If it is loose enough to allow the piston to work in the crosshead, it would slightly affect the operation of the gear, but ordinarily it does not.

"Q. Was that key being out of the gear the cause of that engine going through the wall at Council Bluffs?

"A. That was a pin."

"Lever not holding" would mean that it would be difficult to maintain a proper cut. The lever not holding indicates that the quadrant in the latch, that is, the teeth in the latch of the quadrant are worn, and that the lever slips.

"Lever bracket loose" would be the same condition as the bracket loose on the boiler. There are two brackets, one under the boiler and one in the cab. The reports are similar, and the conditions are similar, except one holds the cylinder and the other the lever.

"Reverse rod broken" would preclude the possibility of an engineman making a cut-off or reversing the locomotive except after he would take a bar, or some instrument, and go down on the ground and move the position of his radius bar and link block, but he could continue with his train after he had changed the position of the different parts of the valve motion. While the gear would be inoperative, the locomotive would still be serviceable.

(Statement showing estimated cost figures for applying power reverse gears to Union Pacific System's locomotives received in evidence marked "Exhibit No. 57, Witness Burnet.")

The cost is based on the repair of material, plus the manufacturer's price of the gear, plus overhead expenses or operating the plant that does the work.

The exhibit is based on the last type of gear which we applied, the Franklin type E, which is the latest development of the Frank-
1391 lin gear. It is neither a Ragonnet nor Precision, but a combination of the two, a better gear than they have ever put out before. It is lever operated (T. 5001–5012).

J. W. BURNETT

CROSS-EXAMINATION

As general roundhouse foreman in 1917 to 1921, the territory between Omaha and North Platte, known as the first and second districts, Nebraska division, was under my jurisdiction. My headquarters were at Grand Island, Nebr., and I had jurisdiction at that time only over the terminal at that point and the engineers operating into and out of that point; they operated from Grand Island to Omaha and Council Bluffs and from Grand Island to North Platte. I had no jurisidiction over Council Bluffs or North Platte. They were the turn-around points at the other end of the run. I had no jurisdiction over the yard engines at Council Bluffs.

As district foreman, the territory between Laramie and Rawlins, Wyo., known as the sixth district of the Wyoming division, was under my jurisdiction. There were yard engines at Laramie.

As master mechanic, my headquarters were in Cheyenne, Wyo., and I had territory from North Platte, Nebr., to Rawlins, Wyo., on the main line, and including several branches.

As assistant superintendent, and superintendent of motive power from December 1928 to 1930, and assistant general superintendent of motive power to date, my territory was the Union Pacific Railroad proper, also the St. Joseph and Grand Island Railroad—two railroads.

When exhibit 54 refers to "Union Pacific System" as I understand it, the report covers the Union Pacific Railroad, the Oregon Short Line Railroad, the Oregon-Washington Railroad & Navigation Company, the St. Joseph & Grand Island Railroad and the Los Angeles & Salt Lake Railroad.

To my personal knowledge, I do not know of any reverse
1392 gear casualties on the railroad on which I had jurisdiction in the years 1926 to 1930, inclusive; nor do I know of any not included in exhibit 54.

"Mr. SMITH. I will state this exhibit was introduced by Mr. Warfel and that is supposed to properly represent the situation with respect to reportable accidents, and there was only one in the five-year period.

By Mr. MCLAUGHLIN:

"Q. Mr. Burnett, since you have had supervisory capacity on the Union Pacific proper, and before that time, do you know of any manual reverse gear casualties that you have not told us about?

"A. No, sir; I don't know of a manual reverse gear casualtiy in my experience in railroading.

"Q. To refresh your recollection, Mr. Burnett, do you know that on September 18, 1920, at Council Bluffs, Iowa, engineer Walter H. Calme had a compound fracture of his right thigh sustained when the lever on the locomotive which he was operating, being engine no. 4411, while the engine was moving from five to six miles an hour went from forward to backward motion and struck him on the thigh, and then went back and forward several times, due to a bolt coming out of the left eccentric crank arm, which caused the crank arm to come off the main pin?

"A. At that time my activities were confined to Grand Island, Nebr., and I would not have any way of knowing of the circumstances surrounding an injury that might have occurred to a switching crew in Council Bluffs, Iowa.

"Q. Did you make any investigation before you came down here to ascertain whether or not there had been any manual reverse injuries on your property?

"A. Only to the extent of talking to our safety department, who investigated to determine whether or not there were any.

"Q. And they told you that there were none?

1393 "A. They told me that there was only one, and that was a minor injury which occurred to an engineman up in the northwest, on the Oregon-Washington Railroad & Navigation near Albino.

"Q. Then, if your company reported the accident I have just narrated to Engineer Calme to the Bureau of Locomotive Inspection, they failed to advise you of it?

"WITNESS. I had no advice of that accident, but it is my opinion if that accident had been reported the primary cause of the accident was the bolt coming out of the eccentric crank and not anything in connection with the reverse lever, and it would be so reported.

"Q. But my question was whether the safety department had informed you of that accident?

"A. My question of the safety department only covered the accidents in connection with the handling of the reverse lever and not to other parts of the locomotive that might fail—that affected the performance of the lever, and they did not advise me of that accident.

"Q. The reverse lever was the instrumentality that injured this man, was it not?

"A. You say it is. I am not sure. I don't know anything about it.

"WITNESS (continuing). As to whether it would be possible for the engineer to be injured, no matter what his position in the cab: It is possible for anyone to receive an injury on any moving machinery; it would be possible to receive a very minor injury in handling that steam gauge. The dials on steam-pressure gauges do not move. In pulling steam gauge handles off of the dial I have cut my fingers. As to the comparability of that kind of injury with the one received from a Johnson bar getting out of control: It is comparable to the degree that any movable body might be a possibility for an injury."

1394 In my opinion, it is possible, but not very probable, with the engine in motion and the bolt coming out of the left eccentric crank arm that the lever may get out of the quadrant and thresh back and forth.

I am not acquainted with the fact reported on February 16, 1924, Engineer C. J. Madden operating engine no. 245, while standing, reported the lever not working freely and that an engineer, leaning against it attempting to move the lever to back motion, bruised his breast and was off a week due to such injury. I have observed an engineer pushing against the reverse lever with both hands trying to get it from one motion to another; also brace themselves when handling the lever—as to the cause, it is understood that when you move any lever you will place yourself in the handiest position possible, and in order to give a man purchase to move a lever he will naturally brace himself—a lever the size of a hand reverse gear lever; and we go so far as to provide a place for him to put his foot, so he can brace himself easily. I would not say he would have difficulty in handling the lever unless he did brace himself. I have operated switch engines as the engineer and I never used the brace. I do not think they are necessary as appliances on manual-reversed

engines. They are put there at the request of our enginemen, as a matter of convenience to them; as a matter of ease in their work. It lessens the burden on them to place themselves in a comfortable position. They were not requested because the levers were too hard to move without a brace. There is some burden in handling a manual lever. Our engines equipped with power reverse do not have foot braces because the power reverse is not located so that a foot brace would do anyone any good. In some cases with the power reverse gear it is necessary to brace yourself; I have personally had to put my foot up on the boiler head to reverse the power reverse gear.

1395 It was a new reverse and of the old type that reversed very slowly and not on exhausted pressure but at the same time it would admit pressure; it was a Ragonett. That trouble to some extent has been overcome. We have recently gotten into it more by increasing the air pressure. We carry 130 pounds in the slide or rotary valve, as the case may be, as against previous years when we had that reduced down to 95. From actual experience, I understand that the greater the air pressure on the valve of the power reverse gear it requires additional effort on the part of the engineer to reverse the engine; not to the extent of needing two hands to pull over the operating lever. That effort would only be necessary when that was combined with some tight bearing or something in connection with the gear where the two were combined making it necessary for him to get up and brace himself to pull it over. Combinations of circumstances, such as new and tight gears, parts of the gears fouling on other parts of the locomotives, combined with the high air pressure we use, making it necessary to use two hands in operating the present type of power reverse we have on our locomotives. By new and tight gears I mean gears just out of shop after general repairs. As to testifying that I never put an engine out until properly broken in and easy to handle: I often put out gears that are not turned out as engines. We change those gears about every six months; the engines only go through the shops about every 18 months.

When speaking of a reverse gear that will sometimes foul other parts of the engine: I have reference to the reach rod of the gear coming into contact with the jacket or the edge of the cab, something like. That would make the lever in the cab hard to handle (T. 5013–5024).

"Q. Those gears are not in proper shape if you send them out in that fashion, are they?

"A. I did not say that we send them out in that fashion. You asked me if I had experienced that, and I have. I have not said yet we send them out in that fashion.

1396 WITNESS (continuing). That is a condition found by our inspector; not an operating condition found by engineers on our road. We do not have any of that trouble on the road with the engines in service."

I question the statement that engine no. 222, handled by Engineer W. J. House, in switching and while dropping cars, the manual reverse lever became unlatched and flew back and strained his wrist and that he reported the accident and was furnished with a power reversed engine, because at that time the engines of that class were not equipped with power reverse gears; neither are they today. He could have been furnished a heavier switch engine of the Mikado type that was power reverse geared. I know of no reportable injury. There may have been some minor sprain that was not reported to me.

I would say the case of a manual bar coming unlatched and flying around in the cab is significant because a man operating a locomotive under those conditions is surely negligent in his duty and he might become injured. He, as an engineman, is supposed to know the condition of the engine when he leaves the terminal and he has no business operating a locomotive in that condition, neither do we demand or ask it. Aside from breakdowns, before he gets very far with it he should know everything that will cause the lever to come out. I take the position any engineer, out with a manual reverse lever and it comes out of the quadrant the second time, he is to blame for it. Not the first time; but he is negligent if he is in a position where he can receive an injury as a result of the reverse lever getting out of the quadrant. Any time he has occasion to handle the reverse lever it is disengaged from the quadrant. He has no connection with the quadrant whatever. In the case of the lever coming out of the quadrant on a passenger run while out on the road, I would not advise the engineer to give up the engine; if he sees weakness there that would indicate that the gear would
1397 come unlatched he should hold the latch the rest of the trip in place with one hand, which, in my opinion would hold it; if necessary we would expect him to use two hands. I have not seen him do that; but from an economy standpoint he should not let an engine come unlatched and go down into the corner on a high speed passenger train. He would tear up his fire and waste a lot of fuel. He does not have to hold the lever. I think one hand helps hold the latch down, and if the spring is not quite of sufficient tension one hand on there will hold it down. I have done that myself, experimenting to determine just what would happen under those conditions. I have done it on several occasions in order to observe the effect upon a fire of lost motion and different things about the gear. I have had reports of worn quadrants and while I did not develop that this worn quadrant would in any endanger the life of enginemen, I have investigated, at different times, to what extent we could permit a quadrant to wear before we would spend money renewing it. I cannot give exact dates but there is a safe margin in the wear of a reverse lever, of the hand reverse lever latch, as well as a safe margin of wear in the teeth on the

quadrant. As a supervisor it was my business to determine where the safe margin was and to keep my engines within the safe margin.

If the quadrant teeth are worn an unreasonable amount and rounded the latch will not hold in all cases and a weak spring will contribute to that latch lifting and if the reverse lever became unlatched there are circumstances that would cause the lever to move on the quadrant.

As superintendent of motive power, with jurisdiction over the Union Pacific proper, I have a general knowledge of the performance of manual reverse levers on our property. I am not familiar with every detail.

1398 I was not informed of an occasion on July 30, 1930, when the reverse lever jumped out of the quadrant and flew in backward motion, pinning Engineer George Ranson between the lever and the back cab, bruising his arm, resulting in a week's layoff. These engineers may have things like that happen and I would not know anything about it.

I don't know anything about any accident on the Oregon Short Line, the Oregon-Washington Railroad & Navigation Company or the Los Angeles & Salt Lake.

I cannot say that I have had any complaints in any respect about the manual lever from the enginemen. I have had engines in different assignments where the enginemen would ask for a power reverse gear, which I have supplied. I don't recall any complaints from any committees. But all railroads have engines in different services that are harder than other services, and we are interested in an engineman and he is interested in his work and if he asks for it, the chances are that he will get it.

As to equipping locomotives with power reverse gears: Some of it was put on at the request of local committees. I talked to one Kennedy, local chairman at the time but not now, about putting an air reverse gear on an engine for an engineer with a wooden leg who was not able to move around on the seat readily when he wanted to switch in backward motion and I put a reverse gear on a switch engine for that particular fellow at Laramie, Wyo. There may have [illegible] particular instances. In the case of putting a power reverse gear on the switch engine in Omaha: I did that for the engineer himself. I have lived with the local chairmen for a good many years and they might say something that would not register with me or I would not pay any attention to it and they might tell you that they made a request. My company, when the conditions warranted, only as I have outlined,

1399 equipped yard engines with power reverse gears.

As to whether it is a fact that they were equipping with some regularity the engines on our property up until a certain time: At one time we tried to select the service and provide the gear where the enginemen would request it. We put on some. I don't know of any policy that has ever been adopted. I think switch engine

no. 4442 was the last one equipped with power gear and that was early in this year. I cannot give the dates of the next one before that. I will say that possibly one or two, but not over, were put on since the Bailey accident on January 16, 1929. Since that time we have bought some new engines, equipped with power reverse; also, since that time we have removed power reverse from some mountain type passenger engines and replaced them with the Caprotti hand motion, as I testified this morning. Of all the engines we own, that is the only one we converted back to hand reverse; and that for a special design and reason. I cannot say that we had any program for the equipment of certain classes with power reverse gear before the calamity overtook us. We have not objected to putting on a reverse gear when asked for in order to make the work easier and it does make it easier to some extent, and especially in cases of an old employee who would make the request himself.

"Q. What I had in mind, Mr. Burnett, taking these improvements you were talking about this morning, I take it you were going to take the injectors off of certain types of engines and put inspirators on all classes of engines?

"A. Yes."

Two years ago we had a program of removing a certain type of power reverse gear on passenger engines and using those second-hand reverse gears that were no longer suitable for passenger service on the lighter power that would find their way into switching
1400 service where the circumstances justified it and the engineer wanted and made a request for it.

My opinion, that if the engine which crushed Mr. Brunnel's skull had been equipped with a manual reverse the accident could have been prevented, is based upon my own experience in the result of tests I made after I heard of this accident in the hearing in June, I believe. With that accident in mind and for the purpose of determining in my own mind whether or not a man could really and readily detect any obstruction in the valve motion of a hand lever, I placed boards across the farm [frame] under the tumbling shaft between the eccentric on Stephenson engines, and things like that, and it is my opinion that a man in the cab could detect the obstructions. As to the comparability of a board to a man's skull, it is comparable to the extent that a man would feel any part of a man like he would a board; a hand reverse gear cannot hit very hard. I do not entirely base my testimony on those tests. I could go back a number of years when I worked as a machinist. I would frequently have occasion to handle the reverse lever while some other mechanic would be working in the pit, especially in connection with putting up blades, and things like that. We would familiarize ourselves with the operation of the lever when the locomotive was standing still. The tests I spoke of were made around the yard with the yard engine. I have run an engine out on the road but I cannot say that I have ever felt any obstruction on the road. My work

around the shops was in the line of repairs to the round house or back shop and I have felt a lot of obstructions there, such as buggy bars, wrenches of all kinds, different tools used by mechanics. I do not recall ever having an obstruction that was a part of a man's body. I do not recall of ever having a time when a nut or something was caught in the motion. Most of the cases to which I
1401 referred were articles placed in the motion for the purpose of repairs. As to what I would do when I felt the obstructions, it would depend upon what I started out to do. I would probably put the obstruction there for a purpose, and I would probably move the obstruction a little bit further. Most of these obstructions were used in the parts for repairs in order to line up the different holes for the application of pins. Those were prearranged obstructions for a definite purpose. Nobody knew I was making the tests with the boards and nobody helped me. The injury happened to Mr. Bunnel at 6:55 p.m. and they called me directly afterwards about 7:45 that night. It never occurred to me before that accident to make a test of that kind; I never thought of the possibility of the injury being avoided by a hand gear until this hearing.

I do not know the number of locomotive-miles made by either the hand-reversed, or power-reversed engines as included in exhibit 56. As to whether the miles run is any indication of the extent to which the reverse lever is used: We have no way of telling the miles run by yard engines (T. 5026–5045). We have a way of telling the miles run in passenger and freight service. We usually estimate the miles at six miles an hour in switching service. I would say the actual miles run in switching service are not an indication of the use made of the reverse lever because of the different services. An engine switching on a transfer job would make a lot of miles and the lever would not be moved a great deal, but another engine in the same yard used on a train switching job, the lever would be used a lot, but the engine would not make a great many miles. So there is really no connection between the number of miles run and the number of times the reverse gear might be used.

The 301 hand-reversed engines dispatched, noted in exhibit 56, are used in switch and local freight service and local passenger service.

1402 The power-reversed engines are used, some in switch, through freight runs, through passenger runs. That is all of our work combined. Some of it is not very heavy; at present we haven't the business to make it heavy. We are hauling short trains.

A large percentage of our hand-reversed engines are out of service now and in storage, which was true when this statement was made up in March, which accounts for the small number of hand gear arrivals as compared with the power reverse gear arrivals in the same month. Engines are often arrivals but not dispatched in that month.

I will say that every engine reported is given some attention. There have been engines reported a second, and even a third, time where the defect would not be located by the mechanic or found by the engineman and entirely corrected as a result of the first report. I do not think that would be true of the hand, as well as the power reversed, because there are no hidden parts to the hand arrangement; on the power reverse gear we frequently find where an engineman reports gear creeping and we renew the packing and do not get the trouble, and the next time we lift the valve up and find the defect there.

I don't know whether the three reports of gears working hard are on the same engine or not. I have seen reports that the latch spring was too stiff or too weak. It is possible that they do not always get it fixed the first time; they may get it too much other way.

As to the difference in the defect between piston packing and rod packing, as given on exhibit 56: The rod packing is in a stuffing box composed of rubber and asbestos and some cloth, and it is applied under tension to make an airtight joint between the piston rod and the cylinder, while the piston packing is commonly called a cup and is expanded against the sides of the walls to maintain a uni-
1403 form pressure on both sides of the piston head. The piston packing and rod packing are two different things. The piston packing is inside the reverse gear cylinder casting, ordinarily called the cylinder packing.

With reference to the main rod breaking on the engine going down the mountain, testified to by Mr. Bailey, the main rod was damaged in the process of manufacture of the steel that went into the rod, and a few inches ahead of the butt of the rod the steel contained a piece of slag that was not visible to the ordinary inspection; that was the primary cause of the accident. In a similar accident, the only thing the engineer would be able to do with the hand lever would be to reverse the engine and give her steam; at that speed that would not have resulted in stripping the engine. I have reversed engines at 60 miles an hour to determine whether or not you could strip an engine with the reverse lever, but not with the main rod or any part of the valve motion broken. I would not agree with an engineer testifying that it was dangerous to handle the reverse lever by changing the position of the lever one or two notches, as the case may be, at 60 miles an hour.

My only experience as an engineer has been as a yard engineer perhaps aggregating a week in my life in different days at Kearney, Nebr., brought about by an engineer of the road failing to report or getting sick or something and I would use the yard man and would go out at different times and take his place until I could get a man there for the extra board. That is I would take the man off the yard engine who was a qualified road man and have him run the road engine and I would run the engine in the yard until I could get a man to run the switch engine. That was between 1913 and 1914.

I cannot recall the name of any fireman who ever worked for me while I switched perhaps a half day at a time. I was roundhouse foreman at the time.

At this time I do not direct the movement of engine crews. I have nothing to do with their assignment. That is handled by
1404 the division superintendent and his staff.

I said my experience in actually running an engine, taking the place of the engineer, without the engineer being on the engine, when I was in charge of the engine, would aggregate about a week. At the time I was qualified and examined as a hostler by the trainmaster, I believe, and I did all my own hostling. The extent of the examination was to be familiar with the hand and lantern signals (T. 5046–5059).

I said I never heard of a reportable injury from a manual reverse lever on a locomotive. There is a distinction between a reportable injury as a result of operating a power reverse lever and one that is not reportable. I have pinched my fingers in operating the reverse gear by my own negligence by not properly placing my hands on the lever and have squeezed the latch lifter with my own pressure to such an extent that I would pinch my fingers. I cannot say that I have not heard of others who have pinched their fingers. That is the only injury I have had so far as reverse levers are concerned. I have never heard of an engineer being hurt in any way account of the reverse lever coming too close to appurtenances or to the boiler head, or something of that kind.

We have a stop on the manual reverse lever at the front end of the quadrant, on our engines, to prevent clearance. That would be in violation of the law if the reverse lever would come too close to the boiler head when in extreme forward position; the stop is to prevent the reverse bar from coming too close to the boiler head and the appurtenances. It is not a printed law but a rule of the inspectors that there must not be any restriction from any valve to any lever or cup in any position; the engineer must have ample clearance to properly work the valve or lever. I have never heard of any of those stops being misplaced in any way. I do not recall at this time that I have ever had any report from an engineer of any
1405 kind that his reverse lever was too close in forward position, but I would not want to say yes or no.

I have recollections of taking temporary stops out and putting in permanent stops where a man would lose a stop en route and he would stick in something of a temporary nature. I cannot give you any dates.

I will say that in operating a locomotive I have not felt an obstruction in the manual reverse unless I was looking for it and it had been called to my attention by some shop man or engine tamer on some engine that was being prepared for service, or something like that. It is correct as I stated that the only obstruction I ever felt was while I was making the test with the boards and

while I was working as a machinist that was due to wrenches and that sort of thing in the parts while the engine was undergoing repairs.

In the cases testified to here by these engineers and other cases that I recall where I have had complete stoppage of the steam line due to neglect of maintenance. The steam was not turned into the gear but into the line to the gear, which is a part of the gear. I have known cases where the steam was turned into the gear where it did not work a hundred percent. I don't know of a case where it would not work to some degree but I know of cases where it has not worked to the satisfaction that would be expected out of a reverse gear. The air does not work a hundred percent; so I would not expect the steam to work a hundred percent.

I have known of cases where the steam was turned into the gear when it failed to work in such a way that the engineer could not proceed with his train but it was due to some broken part of the gear where the steam would not be effective. I do not know of a case where the steam was turned into the cylinder and it failed to operate the piston.

1406 I would not agree that failure of steam, turned into the cylinder, to operate the piston was due to clogging of pipes or valves or improper application of gaskets. I have the position that the steam, as supplied to reverse gears today, is not practical. The pipes between the boiler and the reverse gear cylinder conveying steam to the gear will corrode. I have taken them down and cleaned them out. As to the length of time it would take to corrode: It depends upon the condition of the water used in the locomotive. I should say the quickest one could corrode them would be at bends and elbows in probably a day's service of a locomotive in bad water territory to the extent that you would not be able to get sufficient steam through them to operate the gear. That is really not a surprising amount of corrosion when you see some of the way things corrode. By corrosion I mean the formation of mud, caused by bad water, coming out of the boiler past the valve; the valves leak just a little bit and there is a pocket there and the substance will go by the valve and stop here and there. That amount of corrosion could exist under extreme conditions. I do not say that I have seen it exist, but I have seen solids hardened so that you could not force it out but had to dig it out, where I have every reason to believe that it was a rapid formation in different pipes on the locomotive. I have not had experience in the 24-hour period of that kind but it is my opinion that there are territories where that condition could exist; it is through territory over which I had jurisdiction in the past but not at present. We haven't that water condition on the Union Pacific now (T. 5060–5070). To avoid that condition, we have installed water treating plants; the water is treated and in some cases we wash our boilers more frequently than we did in years gone by.

1407 As to the length of time at present on my territory for pipes to corrode: The worst condition is on a branch line where an engine is worked an average of eight hours a day. I am satisfied that any steam valve not in use would corrode to the extent that it would stick the valve and at least fill part of the pipe in a week's time. We have no power reverse gears on that branch line. In that bad water territory we do not have engines regularly equipped with power reverse gears working. We occasionally run an extra engine, equipped with power reverse gear, in there.

As to the territory where we have power reverse gears: I would say that you could move the valve if it receives regular attention at monthly inspection periods. In my opinion it would take longer than a month to corrode up under those conditions. We make periodic inspection of the working of the valves and pipes carrying steam to the power reverse gear to see they are properly cleaned out and in an operable condition.

We have 950 engines equipped with power-reverse. Referring back to my testimony that, in some instances, we equipped locomotives with power-reverse to lessen the work of the engineer—the only influence that has been brought to bear for the application of power reverse gears was by the local chairman, at different points, who handled the matter with me personally. That is what I had in mind when referring to a committee. For the bulk of the installations of 950, I don't think it was the request of committees of men that had anything to do with their being put on. But you must take into consideration the advent of the wide fire-box on American railroads. Largely it was due to the change in design of the locomotive that resulted in the installation of power reverse gears. Also, as I said before, requests of enginemen and our effort to cooperate with them also entered into it.

1408 I would say that not far from 20 power reverse were put on at the request of enginemen, including the nickel-plated one and the one for the wooden-legged engineer. With the number that we have now, it is an insignificant number. I am not qualified to say that more than 900 have been applied without the request of enginemen. I say that since we have bought this modern power with the wide fire boxes that we have felt it was a necessity to the design. I don't know what the request from the enginemen were as 1911. I cannot answer that question.

I don't recall when I first noticed that power reverse had resulted in excessive fuel consumption. I have commented about it in numerous fuel meetings. We have discussed ways and means of preventing this waste. I have not made any tests to determine the waste of fuel. I don't know that my company has made any tests, but we have taken records and compared them with other records of trips of engines that would have a creeping gear and compare it with a trip of a similar engine that would not have a creeping gear. I have not reached any conclusion as to actual pounds of wasted fuel, but I

have observed it and know it amounts to considerable. I have no accurate way of measuring the amount in pounds.

I have had mechanical supervision of the power reverse maintenance in my territory about 14 years and there has been improvement during that period that they have strengthened different parts so they do not fail in service. To some extent they have increased the size of bearings so that wear does not take place as rapidly as it did at one time. I can't say they have improved the mechanism with respect to creeping except the Barco, which when new will last longer than most gears before it starts creeping, but it will creep after
1409 wear and lost motion develop in the gear. As to how long the Barco would be in actual service before it would begin to creep: that would depend upon the service and the circumstances and whether it was lubricated or not. I have had Barco gears where the creeping could not be corrected without buying all of the parts of the gear new except the cylinder casting. There is a report showing how many Barco gears we have. My idea is we have about 30. The Barco gear when new will run quite a while before requiring extensive repairs. Then you take up on the adjustments that are supposed to overcome that creeping and apply minor repairs to the different parts of the gear and it can be kept in service possibly to the end of the second year before it is necessary to renew major parts.

The Alco is a cushion gear and with it we experience troubles universal to all gears—packing difficulties. It does not cost much to keep either an Alco or Ragonnet gear in shape—a matter of the renewal of this packing all of the time. A number are trying to improve the packing but I have not seen any improvement. The fuel campaigns have become so intensive in the last four or five years we have all tried for improvement in the packing, but if any improvement it has been very little.

There has been improvement in both rod and piston packing, noted in exhibit 56. There are at least a dozen kinds of packing used; some companies have developed packing which is an improvement over the other used for the rod. I don't know of any improvement in the packing materials used for gaskets. They still blow out occasionally (T. 5071–5082). We have gaskets in some air-brake equipment on which we have failures. The improvement in the packing has improved the condition with reference to creeping.

REDIRECT EXAMINATION

If there has been any improvement in packing since exhibit 56 was made up in March 1931 it is unknown to us because we
1410 have not changed our grade. During the time exhibit 56 was made, our laboratory and our practical tests indicated we were using the best packing available and my testimony reflects conditions as they now exist. We still have considerable creeping in

spite of the improvement in gears and packing, but not as much as we had some few years ago.

As to the rapidity with which corrosion builds up: It builds up in the dead pipe more rapidly than in a pipe constantly used if there is a leak or something of a pocket that will permit of the forming of the corrosion.

In regard to failure of the gear to operate soon after steam has been turned in: We have had cases where the steam was going into the reverse gear and the packing designed for air will not hold up any length of time on steam, and as a precaution we go to the extent of taking the packing all out and renewing it when an engine comes in on steam. As testified to here in this hearing, we have had a case where the packing failed resulting in an accident, engine no. 2240, Engineer Aita. The packing in this particular case failed after the steam had been cut in a short time, and the accident was the result of the gear failing to function as a result of the packing failing.

As to how stop blocks are made: There is a hold drilled in the quadrant on our railroad and a pin used, three-quarters of an inch in diameter, which is driven into that hole. In my experience a stop block being lost en route and needing to be replaced has been a very infrequent occurrence.

It requires some effort to operate either type of reverse gear. I don't know whether you would call it a burden or not the effort required by an engineer to operate a power reverse gear. The engineer in moving the hand gear has to exert pressure on the lever. I mean it requires some exertion on his part. According to the dictionary, I don't think that is a burden. In my observation
1411 and experience, there has been nothing in connection with the operation of the hand reverse which would work a hardship on the enginemen.

We change the reverse gears approximately every six months trying to eliminate some of the waste in fuel as a result of the gears becoming worn. The gears are interchangeable. We do not let roundhouses repair gear except those repairs they can make without taking the gears down, or the gears are interchanged and the gears sent to our shop and the new or overhauled gear applied. When the engine is in regular service that is done right at the end of the six months' period. In order to do that we have a spare gear on each engine that is in the shop of the same class. We change the gear off in that way. In addition, we probably have a half a dozen gears on the railroad in the two major shops.

RECROSS-EXAMINATION

The steam application to the power reverse is an emergency operation put there for use in case of the failure of the air. I would not say it is an emergency appliance. It is a part of the regular equipment. It is on there all of the time, and it is all they have to use in

case of air failure. We do not expect air failures all the time but if you did not have air failures you would not have the steam pipe up. If a man has an air pipe break and he stops and cuts in steam I do not call that an emergency; I call that additional appliance put there for his protection.

(Statements covering various classes of locomotives on Class I roads showing separately which are equipped with hand and which with power reverse gears, with other information received in evidence marked "Commission's Exhibit No. 58.")

1412 SCOTT W. SNYDER, 46 years old, testified:

On October 16, 1916, I was a fireman in the employ of the Santa Fe Railroad. I was called at 9:30 p.m. on this day for no. 4 out of Argentine, Kans. We got the engine late out of the roundhouse. It was engine no. 3503. We waited until about 10 o'clock to get this engine and went over into the coach yard and got a mail car and went to the union station in Kansas City. We had left Argentine without getting the engine ready, that is, without oiling around, and we figured on doing this over at the depot. We pulled into the union station with this engine and car and pulled up to the end of the depot, waiting for a fixed signal there, a low dwarf signal. The engineer told me he would get out of there as soon as we got the signal, for me to stay up on the seat box and watch for the signal, and when we got the signal we would pull out, and he would go down and oil around. We stood there only a minute or two when we got the signal and the hand signal. The yardmaster always gives us a hand signal with the pot signal. I turned on the bell ringer and it would not work, and I reached over and caught hold of the bell cord and started the engine up that way. I cut in the headlight before starting and then rang the bell and threw the engine over and pulled out. We pulled up over the pot signal that would give you a back-up main on to our train and we backed right on to the train. When I threw the engine over, this was a compound engine with Baker gear, he was in oiling the guide cups, filling the guide cups for these high-pressure guides, and I caught him between the bell crank and the valve frame and this reversing yoke on the left side. I had pulled out about 150 feet before I reversed the engine and started to back. In moving
1413 the engine forward and then backing it, it was necessary to operate the lever more than once. I threw the engine over to get the forward movement then reversed her to back up, and then reversed her again to make sure that the coupling was made on the train. During all of these movements I did not feel any obstruction. The engineer was caught all of this time, that is, he was not caught when we made the back-up motion, because he was lying there on this frame, but when I made the first move I caught him, and he was unconscious, I presume. Then, when I made the back-up motion and carried him back on the train he just laid there. I think it was the first movement of the lever that caught him. He got well.

I got help and removed him from the engine. He was off duty close to nine months. I do not know what compensation he received. (Counsel stated he received $7,000) (pp. 5091–5095).

CROSS-EXAMINATION

The engineer's name was Gus Carlson. He is in Kansas City on a pension.

I don't know as we have ever had any instructions before reversing an engine. Our practice is, in a case of that kind, standing at the depot or anything like that—there is no precaution we take unless it is somebody who is not authorized to handle the engine. I did not look to see where the engineer was before I started the engine. I knew he was on the ground oiling around. Under the instructions he gave me I figured he would stay in the clear. As a precaution I started the bell, then I stepped over the engine to get hold of the bell cord and then back to reverse the engine. This engine had a power reverse. I think it was Ragonnet. That was in 1916. I think that was the first that came out. If I had had a hand gear I
1414 would have acted in the same way. There is no requirement that we shall display a signal from the forward end of the engine at this point while men are working around. We went there to get this train and backed in on the train and did not use any signal whatever. The blue-light rule does not apply when the engineer is just oiling around. We have the blue-light rule when mechanics are working on a train but out in the field we do not observe that rule. They do not figure on doing any work on the engine when it is setting out.

I had been firing about nine years, then this accident occurred on October 16, 1916. I had had some service as an engineer. The weight of the engine on the drivers was about 200,000 pounds. The engine was a balanced compound Pacific type. There have been no different instructions with reference to the handling of the reverse lever since that accident. I have been on that locomotive since the accident. It is still equipped with power reverse, but it does not have the balanced compound feature. This was a very unusual occurrence. Since that time, when the engineer would get down to oil around, I would not back the engine without knowing where he was. Prior to that time, if the engineer had something to do at the depot, I would make the movements around this interlocker plant. When the engineer is on the ground and we make a movement of this sort, he is supposed to walk to the engine. In making a movement of this sort, we back in on the first or second track on either side of where the engine originally stood, so that it is not distant from where we started. I have run an engine a lot myself, and if I told a man to make this movement, I would watch out for myself. Evidently the engineer didn't think of that, because
1415 he got into a dangerous place. I think the power reverse gear on the engine in this case certainly made a difference. The

engineer's chest was caught between the reversing yoke and the valve-gear frame. With this compound feature there were two cylinders on the inside of the frame. Between the reversing yoke and the valve-gear frame there is only about an inch clearance in forward motion. In backward motion the clearance is about 2½ feet. I put the engine in forward motion. I don't think it squeezed his chest down within an inch; it has a downward motion and a forward motion, and I think as it went down it raised his body up. His chest was squeezed enough to break four or five ribs and affect his lungs. It hurt him so bad that he was unconscious, but I have no idea how much of a squeeze he received, because I couldn't see him (5095–5101).

REDIRECT EXAMINATION

The reason I did not look for the engineer was that he had given me definite instructions to move the engine when I got the signal. This is a rather congested terminal; all of the roads go into this depot. Engineers are supposed to keep on the alert for movements of trains to avoid a tie-up in the depot. We get a signal that they are holding other trains for us to make this movement. No investigation was made of this accident. I was called upon for reports but was not censured in any way (pp. 5101–5102).

RECROSS-EXAMINATION

I have never felt any obstructions in the gear or in the motion when handling a manual lever. Nothing was ever caught which would enable me to feel any obstruction (pp. 5102–5103).

1416 B. F. MOORE, 37 years old, testified:

I was first employed as fireman by the Santa Fe on November 18, 1919. I was promoted in 1923 and started running in 1924. My experience with hand and power reverse gears is about fifty-fifty. I have been running about 18 months. I have never been injured with a hand reverse gear nor have I ever seen anyone injured. I was injured with a power reverse gear on December 4, 1926. It was a Ragonnet. The accident happened at Dugger, Texas, on a mallet type freight engine, no. 3305. I was acting as engineer. I was called out of Sweetwater, Texas, about 2 a.m. and lacked about 20 miles of being over a 104-mile division. I went to spot at a water tank on a hill and failed to get up to my spout. I tried to pull up, and it required me to take slack on the train, and when I tried to reverse the engine to take slack I could not get the reverse gear over in backward motion. I tried several different pulls on the lever, and I told my fireman that I would get down and cut the air to the power reverse gear. I got down, cut out the air to the power reverse gear, opened the bleed cocks on both ends of the air cylinder and I told him to try to put the reverse lever in backward motion. He told me he was not able to get it into backward motion. I told him I could

cut the air back in. I closed the petcocks and cut the air back in. As I did this the engine reversed, or the valve gear reversed, catching my arm and shoulder between the tumbling shaft arm and the air pipes and running board. From the X-ray examinations it was shown that the muscle was crushed about half. I was off duty a little over three weeks. In my opinion this accident could not have happened if the engine had been equipped with hand reverse. The reason I could not move the lever in the cab to backward motion was because the valve stem was sprung (pp. 5103–5107).

1417 CROSS-EXAMINATION

When I cut the air back in and closed the bleed cocks I was standing on the main rod. It is pretty hard to get in without being around the tumbling shaft arm on that engine. If I had it to do over again I would not get into that position. It is hard to do in any other position but it is possible to get in behind the tumbling shaft and reach through and get the valve. The valve was real close but under the running board. I don't know whether it is in the same place now as I have not been on the engine for a long time. If I had it to do over again and had any idea it would do that I would get a crowbar or anything in order to get it around in preference to putting my arm behind the gear. When I was caught the fireman told me that the operating lever was unlatched and kicked back with him at the time he cut the air in. He told me afterwards that he had his hand on it and was trying to get it over. He said he could not get it over, and I said "I will cut in the air", and he didn't say whether he was going to try to get it over or not, that is, the gear. He had hold of it and had it unlatched, he told me afterwards. After the accident the Government engine inspector took a statement from me. I don't remember his name (pp. 5107–5109).

C. W. Law, 61 years old, testified:

I was first employed by the Santa Fe in 1899 as fireman. I was promoted in 1905. On July 9, 1927, I was on train no. 11 with engine no. 3459, and arrived at La Junta, Colo., with the expectation of the engine going through to Kansas City and when we arrived at La Junta I was unable to reverse the engine due to a gald
1418 link block. There were quite a number of mechanics, and the road foreman of engines on both divisions in and out of there and they were all making efforts to get the link block loose. Road Foreman Gilbert, whom I had not seen, was working on the left side of the engine. It was the left link block that was galded. I was in the cab at the reverse lever receiving instructions from Road Foreman Jones. He instructed me to see if I could move the reverse with the lever in the cab. It had a power-reverse. I did not see Road Foreman Gilbert until after he was injured. The master mechanic and roadhouse foreman, I think, were assisting him

across the tracks to where there was a water hydrant. He was bleeding freely about the face, his clothes were covered with blood and he was suffering. Somebody told me he was injured before I got off the engine to see him (pp. 5110–12).

CROSS-EXAMINATION

I paid no attention to who was working on the left side of the engine. I could not say how many were working there except that there were numerous men around the engine working at different things. I was relying upon instructions from Road Foreman Jones and whatever he told me to do with reference to moving the lever I endeavored to do. The engine was a Pacific type about 191,200 pounds, I suppose. I do not think there was anything the matter with the power-reverse gear, but I was unable to reverse the engine. I can not say whether I would have had the same difficulty with a manual gear. I do not recollect of ever having had a galded link block on a manually operated reverse engine. However, I have had them where the link block has been tight and that increases the difficulty with which the lever operates (pp. 5112–5114).

1419 WILLIAM HEIRGOOD, 67 years old, testified:

I am employed by the Santa Fe Railroad. I was first employed as fireman in 1894 and promoted in 1897. I have heard the testimony of Mr. Law. I was present at the time Mr. Gilbert was injured. I was the outgoing engineer. I was called to go out on this engine. The engine was going through on this train. I got over there with my stuff ready to get the engine ready to go on through. On the arrival of that engine at La Junta they notified me that the link block was galded but that the engine would be alright to go through. Having ten minutes to get the engine ready I proceeded to do so. I got the oil can and got down on the right side of the engine and commenced to oil around. When I came to the valve gear it was being moved by Mr. Law who was in the cab. The oil holes being about the size of an ordinary lead pencil I could not oil around while the valve motion was being jerked around. While I was waiting on the engine guide step for them to stop working the valve gear something happened on the left side. I had previously seen Mr. Gilbert on the left side, he was the man who notified me what was the matter. When I heard this commotion on the left side of the engine I was in a position where I could see through under the boiler. I saw Mr. Gilbert falling backwards off the oil ladder. He had been working with a bar about 3 feet long. I got down from the oil step, walked around in front of the engine and saw Mr. Gilbert lying on the ground. The master mechanic was holding his head up. I did not see what happened to Mr. Gilbert before he fell back off of the engine. I was looking up in the right-

hand side of the cab to see when they were going to quit working the valve gear. The first time I saw Mr. Gilbert was when he informed me that the link block was galded. When I heard the com-
1420 motion on the left-hand side I looked under the boiler and saw Mr. Gilbert falling backwards. The next time I saw him was when I walked around the pilot and he was laying on the ground. The first time I knew there had been any accident was when I saw Mr. Gilbert falling. I saw him afterwards in the baggage room and later went to the hospital to see him. He was there for some time but recovered. I think he was off duty for more than thirty days (pp. 5115–5118).

CROSS-EXAMINATION

I was carefully watching the valve gear to see when they would stop jiggling it. Just before I saw Mr. Gilbert falling I observed that the valve gear was jerking. It seemed it was moving three or four inches. There was no unusual movement of the valve motion prior to the time he fell backwards. I saw Mr. Gilbert with the bar but I could not see under the boilder what he was doing. I don't know what position he had the bar in or in what position he was using it (pp. 5118–5119).

LEONARD A. PEARSON, 32 years old, testified:

I am employed by the Santa Fe Railroad. I heard the testimony of Mr. Law and Mr. Heirgood. At the time of the accident I was in the cab of this locomotive in the capacity of fireman. I saw Mr. Law. I was busy getting the engine ready, going out on no. 12 on that date, engine no. 3459. I was oiling the stoker around and I happened to glance up. I knew Mr. Law was holding the reverse lever latch open and I just happened to glance up at a time
1421 to see the reverse lever drop to the forward motion, about five or six notches. It dropped suddenly and Mr. Law had hold of it at the time. I cannot state whether the drop of five of six notches was due to what Mr. Law did or to some other force. The engine was equipped with power reverse gear, an Alco make, I think. By the dropping of five or six notches of the reverse gear I am referring to the operating lever (pp. 5120–5122).

CROSS-EXAMINATION

I don't know what caused the reverse lever to drop. I hardly think Mr. Law pushed it down (p. 5122).

(At this point counsel for complainants moved that testimony of Witness Pearson be stricken, on the ground that there is no evidence that Mr. Gilbert was injured by the reversing gear. Motion denied.)

1422 GEORGE E. KING, 70 years old, testified:

I am employed by the Santa Fe. I went to work for this road in 1889, began firing about 1890, and was promoted in 1895. I began running a switch engine in 1895, and went on road work in 1898. I have had experience both with hand-and-power reverse gears. I have never been injured, nor have I seen anyone else injured, with the hand reverse lever. I was injured with the power reverse on July 28, 1916. The engine was a Pacific type, no. 3517, and was equipped with the Ragonnet type of power reversing gear.

I was called on July 28, 1916, for no. 5 to go west at 3.25 a.m., on engine no. 3517. It was about 2.30 a.m., when I arrived at the engine. No. 5 was a passenger train to Denver. I got up on the engine, lit my torch after I had put on my clothes. This Baker gear has a good many pins and it is always the handiest to oil it by putting it into back motion. The operating reverse lever to the power reversing gear was on the center, straight up and down. I took hold of it and pulled it over into the back corner, picked up my hand oiler and got down and went to climb up on the ladder that we had to get on to oil. I put my hand up there, and about that time she let go. She had not responded with the lever. The air pump was working when I got on the engine. It hit the torch and I caught my hand in what they call the carrying bar resulting in a concussion of the left hand and a laceration and fracture of the little finger. I walked back to the gangway where you go up to the cab. The fireman was up there on the left side of the cab lighting his lantern. I called to him and said: "Look out for the engine. I am going to the roundhouse and tell them." The fireman said he did not move the lever. He had no occasion to, and he wasn't
1423 in a position so that he was anywhere near it. I got my fingers out of the handle of the torch and walked right back there and he was lighting his lantern on the left side of the track. I didn't get up into the cab after I had been hurt to see the position of the lever. I could not see the fireman from where I was. I received $100 for this injury, and was off from July 28 to October 31. As far as I know, this accident was not investigated by the Federal inspector. He never came to see me (5123–5127).

CROSS-EXAMINATION

When I pulled the lever from center to back motion, the valve gear did not respond. The valve gear must have been on the center at the time I moved the lever or she could not have slammed back. I don't know positively whether it was on the center or not but I know it was up in that direction the way it came back and hit my hand. I know that the valve gear did not respond or it would not have moved back any more. The valve gear did not seem to respond to the movement of the reverse lever. Whether it did or not I do not know anything except that the crash came.

That is all I could see. You cannot see the valve gear from the position I was in when I pulled the lever back. I don't know whether the gear came back in response to the movement of the lever. I don't know who relieved me. I walked to the roundhouse and told them they would have to get another engineer and they sent me to the hospital. The engine is still in service on the Santa Fe. It hasn't the Baker gear but it is still in service. It has power reverse. I could not say how long after the accident, it operated with the Baker gear. It was not taken off right away. I ran it with a Baker gear before and after the time I was hurt. I did not have any trouble with the operation of the gear either before
1424 or after my accident. I do not know whether the company made any repairs immediately following the accident. I never found out what was the cause. They said they could not find anything and I did not stop to look for anything (5127–5130).

B. H. CANADY, machinist for the Santa Fe Railroad, living at Winslow, Ariz., testified:

I was originally employed in the railroad service by the Santa Fe as machinist apprentice in 1910. I graduated in 1914 as a journeyman machinist and worked as a machinist. I worked for the Santa Fe two or three times as well as the Texas & Pacific, the Frisco, the Denver & Rio Grande, Northern Pacific, Chicago, Milwaukee & St. Paul, and Southern Pacific. My work on the roads named was roundhouse work. My service with the Santa Fe has been practically continuous since 1918. At the present time I am employed at what is termed Federal inspection jobs, testing out locomotives before they go on their trips and signing Government forms, such as popsetting and labor-saving devices on locomotives. I have been on this job a few months. Since September 1, 1923, I have been on a combination air job and valve setting job in the roundhouse. During that time my work has included repairing of power reverse gears. During my railroad experience, I have engaged in experimental work in connection with valve motion and other machinery parts of a locomotive. I have, at this time, more than one patent that I have applied for and secured on railroad appliances and some that I have not patented that have merely been a kind of testing work on valve motion. The patents I hold are not on valve appliances. I am familiar with the action and function of the
1425 valve gear and the power reverse gear and the hand levers on locomotives of the Santa Fe and other railroads before mentioned.

I was promoted in 1920 to assistant roundhouse foreman at Winslow and along with that job I held the temporary night roundhouse foreman job and was put on as day freight gang foreman in charge of freight engines on days. I continued my work as foreman until the 1922–23 strike. Since September 1, 1923, I have been a machinist. I have specialized more or less in valve setting even before I was a journeyman in 1913 and 1914. In my "boomer"

days I generally fell heir to the valve setting job more than anything else.

With respect to the work reported by engineers from time to time on locomotives that were being serviced at Winslow, the practice on the Santa Fe is for the engineer to make out his work report on a form sheet. He makes it out on the top half, together with the printed form as to condition of brakes, bearings, safety appliances and the like and then follows that with an itemized account of his work. The lower half is divided up with a space for the incoming inspection of the locomotive by the incoming inspector. The other half on the right hand side is for the outgoing inspector. That sheet is made out and hung in a frame in front of the locomotives in the roundhouse. As you get a job on it the foreman gives you a slip on the job and when you have completed the job, it is necessary for you to sign your name back of the item reported on the wall. You naturally read over the work report to find the item that you have the work on and in the job we are on now we always read the entire report so that we are in a position to know what work has been reported and what disposition was made of
1426 the job so as to be better able to make a thorough inspection of that individual work before it goes on the line or goes out into service (5130–5135). I never kept any record while at Winslow of the engines reported as requiring attention to the power reverse gears. Merely from memory, I would judge a third reported as unsatisfactory, that is necessary for a report to be made on them. These reports indicate: oil reverse gears, pack reverse gear piston rod, reverse gears creeping, take lost motion out of reverse gear. By far, the most are reported creeping. This creeping may be described as follows: An engineer wants a fixed point of cut-off. That is controlled by the amount of valve travel that he gets. He controls the amount of valve travel by the position of the link block in the link and that, in turn, is controlled by the position of the reverse lever on the quadrant. On the power reverse gear engine when it creeps it changes the position. As it comes and goes, it changes the position of the block in the link. Therefore, it changes the travel of the valve and alters the amount of port opening which is the amount that the valve uncovers the port and allows steam down into the cylinder. A cylinder that is being worked with a center port opening, if it started right there, it would have the same on all four sides, on all four ends of the cylinder. Every time that the driver makes a complete revolution, he gets a shot of steam into both centers of both cylinders and exhaust. If his reverse gear creeps and changes the position of that block and the travel of the valve, he may get an inch and an eighth on one side, and at slow speed it may change on him and possibly starve him down to $\frac{1}{8}$ on another corner. Working more pressure on one side than another would have a tendency to make his engine surge. Creeping is caused mainly by a leak in the piston rod packing. As the engine

1427 is worked, if the reverse gear is tight so that there is no leak there, the pressure on both sides of that piston is equal so that it will stand put. If the leak was along the piston rod, it releases the pressure on the front side and the pressure on the back side moves that piston forward far enough until the mechanism uncovers the port, the valve on top. When it does, it then admits air to the front end of the reverse gear cylinder and forces it back again until the mechanism checks it and stops it. And it continues to leak off in the same way. It creeps back and forth when that leak develops. That is not the only leak that you can have but that is the one that is 50 percent of the leaks that cause that one trouble. Of course, a leak under the valve and various other things can cause it but that is more noticeable as a leak at the exhaust port than it is from the gear dancing. About 90 percent of the creeping causes are remedied by tightening up on the stuffing box. With respect to the packing in the cylinder itself, about the piston, that is a cup tight packing and once steam has been turned into the cylinder it rarely causes any trouble. It is examined and checked for a blow and a leak but whenever steam has been turned into the cylinder the orders on the Santa Fe are to pull the reverse gear piston up and apply a new cup, or at least examine it and see that it has not been hurt, because the cup is not made to operate any length of time under steam service in the reverse gear cylinder. Therefore, it is strictly for air and it is practically always renewed. It takes the life out of it that holds it against the wall. It takes about 30 minutes to renew this rod packing. To renew the cylinder packing it is necessary to disconnect the cylinder, unpack the piston rod packing, take off the back head of the cylinder, pull it out
1428 and take the follower plates off and apply new ones. The cylinder is always cleaned out well and fresh oil put in. This work will take a machinist and a helper from two to three hours. We have no printed instructions on valve setting. We have few printed instructions in the roundhouse outside of our Government regulations. The rest of that stuff is handled through supervision. They will come down and tell you and if they want the present practice changed they merely tell you that: "From now on do so and so in a different manner."

In valve setting on an engine equipped with power reversing gear in the best of condition so that there are no leaks, the valve gear is blocked. House air is applied to the air drums. You put it into the position you want to run your valves over in for the class of service the engine is going to be used in, whether freight, passenger, or switching, and also what you want to determine, what you are out for, whether you merely want to square the engine or whether you want to catch its lead points or the dead center or the point of cut-off or whatever you are out for. But in all cases, after the lever has been placed where you want it on the quadrant then the reverse gear is blocked. You block it by wedging it. In some types you

have to use steel wedges in the guides along the reach rod. On the latter types they had a set-screw drilled and tapped into the crosshead that slipped along the guide, and you screw that set-screw down against the guide and prevent it from moving. I am speaking of the power reverse gear. With the hand lever you merely drop the dog in the quadrant wherever you want it and it does not move. It is necessary to block or set the power reverse gear because the piston is working inside the reverse gear: that is, it maintains its position by an elastic body on either end, and as the engine is
1429 being dragged by another engine behind, generally a switch engine, slowly so that the valve setter can get his tram where he wants it on the crosshead, or, if it is being pinched over, when his eccentric rod and link come at the extreme angle it has a tendency to kick the block up, the block tries to get away. It is then a straight up and down matter. It has been kicked to an angle, and the block will try to get away, and, as a result, it being connected to the lifting end of the tumbling shaft arm, it tries to push that up, and, in turn, that throws the force back on the reach rod; and, of course, with the pressure being equalized on the two sides of his reverse gear piston if you throw the extra weight of that block trying to get it up and get away, it naturally moves his gear. It moves the piston back until it uncovers the port and equalizes. It would give you an erroneous report as to the travel of your valve, if you were to allow that condition to exist without correcting it, by holding it absolutely rigid so that you would know that one side is going to be absolutely true, that is, so far as the travel of the valve is concerned. There is no necessity for doing this with the hand lever. The hand lever is rigid in the quadrant. It takes the same place as blocking the power reverse. Frequently the engineer is mistaken about the valves being out of square when the trouble is with the reversing gear. To determine that you can either get down and try your air reverse gear and see if it is creeping, and, if it is, take the creeping out of it or you can go down and trail over your valve. Either way you have to do that, so it is as broad as it is long. If an engineer comes in and reports his engine not square, you have to trail over the valves to make sure they need no alteration, and if you find them all
1430 right, you go to the reverse gear and get your reverse gear in shape, or if you so elect, you can go down and put the reverse in shape before you trail the valves. It is a common occurrence to find a creeping power gear where the valves were reported out of square. I would judge that about half of the valve reports on the power reverse gear engines are not in the valves, that is, we find the valve question "okay." When they come back in the roundhouse you ask what was found, you tell them "I found the valves all right but your gear was creeping" and they say, "Well I didn't know which it was." "It wasn't handling the train." We catch it on the hard pull out West and they climb the Continental Divide there west of us on our division. The reason they can't tell the

difference as to whether the valves are out of square or out of adjustment, or whether it is the power reverse gear creeping is, as I said, a little while ago, in order for an engine to be square, it must get the same amount of density of steam in the cylinders at the same time; because when it exhausts if you have an inch and an eighth port opening on one side and $1\frac{5}{8}$ on another side *side*, it will make that exhaust a great deal louder on the side that has more steam, and if his reverse gear has been creeping that much he does not know but that his valve is off. To a great extent you get about the same effect on the operation of the locomotive whether the valves are out or whether the reverse gear puts it out (5140–5146).

On February 16, 1919, I was at Winslow, working as a machinist, valve setting. An accident occurred there on that date. An apprentice boy, by the name of Mespelt, was assisting me on a valve job as he had been for some six weeks or two months. We were sent down to no. 3530 to square the valves. It had been a chronic offender and we were detailed to pinch and secure the dead centers on that locomotive. It was equipped with a Ragonnet reversing gear. We were using Mexican laborers on the pinch bars.

1431 There was a Japanese detailed at that time to the grease-cup job, filling the grease cups on the side and main rods on the locomotives in that shop. During the time that we were setting the valves, after they had been pulled and examined and replaced, the Jap came down and started filling his cups on the locomotive on the right side; just about the time we were through with the right side and were going over to the left. In this operation of valve setting there are a great many chalk marks on the driver tires, main rod crossheads, as well as on valve crossheads and stems. It is very essential that those marks be not erased until the job is completed. We were going to the other side when the Japanese boy showed up and started filling the cups. We informed him that we did not want him around the engine until we had finished because the Mexicans would be plenty to look out for to keep them from getting hurt, without having him there. He picked up his bucket which contained his wrenches, and grease and went on down through the roundhouse. We proceeded to the left side and had finished getting the back dead center on the left side. That placed the right side on the top quarter. The right front driver is located behind the guide in such manner that it is difficult to get to the front grease cup. It was the presumption that the Japanese, realizing that he could fill the right front cup when it was on the top quarter by climbing on the oiling ladder and lying down over the valve frame very easily rather than from the back of the engine. I went up into the cab from the left side and the apprentice boy went around the front of the engine to the right and released the set-screw that was blocking the power reverse

1432 gear in back motion. I sat on the engineer's seat box. As soon as he had released the set-screw, he said: "All right, put her ahead." The Mexican laborers on the left-hand side had been

warned, by me, before getting into the cab to look out for the gear. While sitting on the seat box I noticed the four Mexicans, who were employed in pinching on the right side, standing back against the wall. When he said: "Put the gear ahead", I released it and started it ahead. I did not attempt to throw it from one end of the stroke to the other because in setting valves you always have to be mindful of the possibility of a ring in the port or something else until your work has been completed. When the gear was possibly two-thirds of the way ahead it stopped, and I hollered out to the apprentice boy and told him that he had not released his set-screw enough. He said: "Yes, I have." "It is clear out." I said: "Well, then, there is a bar blocking the frame." I got down onto the floor and just about the time I started up along the fire box there was the Japanese boy still standing on the top of the ladder and lying over in the valve motion. The gear was then still against him. I rushed up in the cab and put it in back motion and went down and rolled him over while he was still across the frame. Just a few gurgles was all that was coming out of him. He was bleeding profusely. He was caught by the reversing yoke of the valve gear. He was lying down so that he could fill the cup when it caught him back of his arms down through the chest. That type is a wide gear. The bell crank assembly is a wide assembly. He was pushed down to within from 5 to 7 inches, that is from 5 to 7 inches of a squeeze. The reversing yoke is about 18 inches and it caught him back of the arms and extended down that far on his body. The squeeze broke practically all of his ribs and tore his lungs all up. The squeeze was a side-wise squeeze
1433 rather than from front to rear. It was in the nature of the gear working on a pivot and not straight ahead. It had a little down effect but mostly it was front and back, that is, forward and backward, and lying in that position, it caught him in the ribs. The action of the gear and the pressure of it shoved him against the yoke. That is what caught him and blocked him on the other side. He was lying with his right side immediately against the yoke. It did not slip him along; it just compressed him up there. In other words, as soon as the valve gear started to move, it began to crush him. He had very little lateral in there. He did not regain consciousness, so far as I know. I think he died the next day in the Los Angeles hospital, just about the time they got him there. His last name was Nomato. I can't pronounce his first name (5147–5153).

This was not the only occasion on which I observed a man being caught in the reverse gear. I caught one in a hand reverse when I was an apprentice boy on the Santa Fe at Newton, Kans. I think it was called the 1451 class of engines and they had Walscheart gears on them and they were hand reverse. The reach rod ran just above the running board down to where the tumbling shaft arm extended up, and it was cut away for that purpose—close to the boiler. When the reverse lever was on center, the reach rod was at the higher part of the arc and cleared the running board more, and when it was in

each extreme corner, the clearance was very close. There was very little clearance. One and seven-eighths or a half inch nut would block it. I don't know how high the reach rod was up from the running board at the highest part of the arc, but I would say 3 or 4 inches or maybe 5.

1434 This was on a back shop engine and I was assigned to get my valve experience with a pretty hard-boiled boomer machinist. He was a mighty good man but he did not leave any doubt in your mind as to what he wanted. He said: "Now kid, you get up in the cab and throw that reverse lever when I holler and I will go around and measure my link blocks and see how they compare, one with the other." "When I holler, you throw it down into the corner. Get it clear down." When he hollered, I put it ahead as far as I could but it lacked quite a little bit of going. There was a tinner who took care of the jacket work putting the jacket on the boiler in front of the cab. He was lying up against the boiler, putting the jacket on and was as close as he could be. He had his knees up against the side of the jacket and his toes under the reach rod, and I put it down on him. He hollered that I had caught him and I supposed it was this fellow I was working with telling me to come and put it down. So I asked a couple more apprentice kids in the cab to give me a hand and so they got on and gave me a hand and we set it down a notch or two more. We got some hollers from out on the running board which we thought were coming from the machinist. We had enough on there to eat the thing and couldn't get it down. About that time, someone stuck his head in the front cab window and said: "Let that up. You have a man caught." He had his toes caught right under the reach rod. It did not cripple him up any. He went right on at his work. I don't think I could have crushed the Japanese with a hand lever, myself; with all the apprentices bearing down on it, we might have cracked some

1435 ribs for him. I don't think I could have hurt Nomato with a hand lever reverse because I could not have exerted over 100 or 150 pounds on it, but with the air reverse gear with an eight-inch cylinder on it, we were operating on the house pressure of 95 to 100 pounds of house air. It was a dead engine. It would have approximately 4,000 or 5,000 pounds against the piston that were put against the job—I mean that much exerted right against the piston head. I was comparing that against the amount that would be exerted against the hand reverse lever. I do not know whether the pressure I could have put against him with the hand lever might have been sufficient to crush him, but if I could have crushed him with the hand reverse lever, I would certainly have cut him right in two with the air reverse. There were that many more times pressure than I could apply by hand. It would have cut him in two like a pair of shears in the boiler shop. I have known of the valve motion parts of a locomotive equipped with power reverse gear moving while the engine was standing without anyone operating the lever in the cab.

I had a valve man, when I was freight valve foreman, put the air on an engine that he was going to check the valves on, and he was under the radius bar, looking up in the inside of his valve cross-head, and it jumped and pinched a lot. It didn't go to the corner. It caught his "wish bone" across the oil cup. He did not lose any time; he said it was pretty sore for a little time. I went up and released that off of him. There was no one in the cab. The power reverse gear was the old type that came out on the old 1600s that the Santa Fe had. It was the old-time Ragonnet with the fine teeth on the quadrant. I don't know how far the reverse lever had
1436 moved. I just walked up as it happened. I don't know where it was when he stuck his head and body under there. I don't know what it had done backing up. This was in go ahead. It just caught him enough down over that oil cup to pinch him but it did not go to the corner. As a matter of safety, I would rather work around a hand-reversed engine. It is safer for a shop man (5153–5159).

B. H. CANADY

CROSS-EXAMINATION

I am now assigned as a machinist at the Winslow shops and for several years past have worked as a valve setter and air man. We only had one regularly assigned valve man on a day's shift. I was on that for eight hours, from 7 o'clock in the morning until 3 in the afternoon. I was handling the entire valve setting. My job was to set the valves, and the air work was done when I would not have any valve setting to do. I would do valve-setting work on from one to three locomotives per day. Never more than three. When there was no valve work, my time would be spent on air work. About one out of three engines reported for valve or reverse gear repair work were equipped with power reverse gears. When business is good, about 50 engines would come into the shops at Winslow for various causes during a 24-hour day. Valve setting on three engines was the maximum for one day. I have worked on as many as eight engines having reverse-gear trouble in one day. The majority of these have leaky parts which can be pulled up with a spanner wrench. All that is necessary is to put an air hose on the locomotive, fill the drums and try to get at the different parts to see whether that is all the trouble. The examination takes
1437 about 30 minutes and the repair work a very short time. My testimony about these repairs and the shape in which the power reverse gear is found is confined to my experience while repairing the engines.

The number of engines dispatched from Winslow depends upon business conditions. At the present time there are a number of our engines in white lead out on the tracks. In fact, our tracks outside of

the roundhouse are full of them. On the shift I am working on now we test everything going out on that shift. We average about ten. There are three shifts. The second shift man gets more. The day shift man gets about what I would get. I imagine 32 to 36 a day is about an average with business as it is. I was not on that class of work in normal times but the number of engines going out then would probably be from 52 to 55. It would depend on how many double-headers there were working up the mountain.

My knowledge about the condition of the power reverse is based on my experience as a valve man and machinist, but is not confined solely to the engines on which I have worked. I do not necessarily work on all of the engines which go out on my shift but I examine the work reports on all of them. When I was a valve setter the only engines I came in contact with were those on which I worked (5160–5167).

Oiling the reverse gear is a routine matter but not routine enough that the engineer does it. He reports it for the shopman to do. Lost motion in the reverse gear accumulates because the gear may not have been oiled and due to the natural wear of the parts. I do not know how long it takes to accumulate enough lost motion that a report is necessary on it. The gear is frequently reported to
1438 remove lost motion when it does not creep. In making an examination, two notches of lost motion are allowed before the lost motion is to be taken up. They consider that necessary for the movement of the valve on the reverse gear, for ease of handling, and, therefore, sometimes an engineer will try it and will see it does not work as well as it might and he will say: "We will make out a report to take up the lost motion and will let the machinist take it up, if she needs it." If I had overhauled the gear the last time I would have a pretty good idea as to how long it takes to accumulate lost motion if that individual gear had come back to me, but not knowing when it had previously been overhauled or the lost motion taken up, I would not know how long it had been running before. It would go six months if it had been propertly taken care of during that time. I have not had enough experience to say whether it will go from one shopping to another. I am strictly a maintenance man in the roundhouse, a repair man, and not a back-shop man.

It seems to me, from a machinist's standpoint, that since 1918, there has been an improvement in the design of power reverse, but I cannot say that there has been an improvement in the performance, as we see it, from the reportable performance. It seems that the present gear should require less attention than formerly. The improvements in design consist of fewer parts which are better concealed and less exposed to sand, cinders, and the like, which have a tendency to get into the bearings and cut them out. Our principal problem is sand storms. There has been a change in the packing, but I cannot say that there has been an improvement. The piston-

rod packing, which causes most of the trouble, is the same as always (5167–5170).

1439 I have had valves reported out of square and found, upon investigation, that they were not out of square and that there was nothing the matter with the reverse gear. The clearance between the parts of the reverse gear where the Japanese man, Namoto, got on is from 14 to 18 inches. I do not know exactly how much they moved before catching him, but as they begin to move they are going to catch him right away. The Nomato accident and the one where a valve man had his chest caught on the guide oil cup are the only two cases I have personally observed where anyone has been injured with power reverse (T. 5170–5172).

The reason why an engineer must exert such force in moving a hand reverse lever, even when everything about a locomotive is in proper condition, is that he has to overcome the friction of the various connections, the weight of his valve. Even with a balanced valve, it weighs a certain amount, and that gravity weight on the bottom of the chamber has to be moved, and while that is practically nothing if well oiled it has to be moved. That together with the resistance of the valve stem packing, which is holding and making a steamtight connection, with the spring in a wedge shape holding it, has to be controlled or overcome on both valves. Then he has to lift the weight of the radius bar and link block. Of course he has the assistance of the tumbling shaft spring, that is, the counterbalance spring, but that won't help him any on the dead weight of his valve. On the old link style locomotive, he had the link to lift, but, of course, that was supposed to be compensated for by the counterbalance spring. Also the lubrication of the valve and the way things are lined up contribute a great deal. If things are out

1440 of line, it has a tendency to bind and that causes a great deal of unnecessary friction. These conditions are no different on small or large locomotives if the lever has been built in proportion to the size of the locomotive. I have never noticed much difference in handling the hand reverse on a small or a large locomotive. I have never handled hand-reversed locomotives bigger than some right good sized freights, but they operated all right. None of our great big switchers are equipped with hand levers, but the type I was talking about is about the same thing. If they were tight any place, they were tight; and if they were free, they worked nicely. On the size we had, our largest freight engines at that time, which were equipped with hand reverse, that was the situation. I do not know of any reason why the larger engines should be equipped with power reverse and the smaller engines not so equipped. I have never heard any discussion as to why they are equipping some with Franklin reverse gears and some others they are not. I do not know why the smaller power has the hand reverse and the larger power the power reverse. The only thing I can say is that the new power is coming out with the late equipment on it (T. 5172–5176).

I have given consideration to the question of design, that is, whether or not it would be feasible and practicable to design a hand lever on this large modern power, and whether there would be room for it in the cab along with the other appurtenances. I do not know, and have never heard a reason assigned, as to why the Santa Fe policy is to have their newer power equipped as it is. In my judgment it would cause some complication to put a hand lever in the cab of the new engines with a wide fire-box because there is not near as much room as in the cab of the other engines.

1441 Where Namato was leaning over the frame there is about 18 inches of space at the bottom and 2 feet at the top. The nature of the bell crank and the reversing yoke arrangement of the Baker gear is such that it pivots from down below this frame inside of it, and when it lays back it lays back at an angle, and as it comes forward it closes that angle. The part at the top where the space is two feet is the reversing yoke. The reversing yoke is a part of the Baker reversing gear, that is, a part of the valve motion assembly. As the reversing gear moves towards the forward motion, and as the top of this reversing yoke moves forward, it closes up the distance of two feet to a considerably less distance. The bottom then begins to work on the action of the bell crank. The bell crank is a series of arms and levers which work inside of themselves, and it is not a fixed point. With respect to the shape of the surface of the reversing yoke that was against Namata's body, it is a combination of the part of the bell crank and the reversing yoke. The bell crank would have gone down on the lower side and the reversing yoke would have come down forward and have caught the top and back side and closed the space in. Unless I knew at what exact point Namato was caught and marked it, and then went down and checked it, I would not be able to tell which part of the reversing yoke came in contact with his body first because it continues to change its relative position at every notch in the quadrant.

Leaks around the pistons cause a little wear on the piston rod of the power reverse, but the packing being of a spongy nature will take it up when compressed. It is not like metal packing in the valve stem of the main valves or the metal packing on the piston rods. It can be fixed up by tightening up the spanner nut,

1442 which forces the packing back in. It is a long threaded nut.

From time to time the piston rods have to be turned and polished so that they wont cut out the packing. They are put on a lathe and trued back, not to their original size, but to their original straight, perfectly round shape. That eliminates whatever wear which may have occurred during the time the engine was out of the shop (5172–5180).

RECROSS-EXAMINATION

When the Santa Fe engines with the wide firebox were designed they could have been equipped with manual reverse but it would have made closer quarters than they now have. They could hardly get into the blow-out cocks, let alone the reverse lever.

REDIRECT EXAMINATION

I am referring to the engines with the wide firebox. These are the ones equipped with power reverse gear. Some engines with narrow fireboxes are also equipped with power reverse gear (5181–5182).

C. A. WILDRIP, 62 years old, machinist for the Santa Fe, living at Chanute, Kans., testified.

I have been a machinist since September 1, 1912. On February 3, 1922, I was testing air in the Chanute roundhouse when I had my right arm broken. I was working on engine no. 3116. I got my air pumped up, and got my torch and went around to look the engine over and found a pipe broken off the power reverse gear from the main reservoir to the power reverse. I removed the pipe and repaired it and then went up to turn the air on the power reverse. As I did it flew ahead in forward motion and hit me across the
1443 right arm and broke it. I turned on the air on the right side of the engine, back of the guide yoke, at the end of the main reservoir. The valve is right back of the guide yoke on the main reservoir above the rocker arm. It was the rocker arm, left arm, that caught my arm. There were two or three fellows working in the cab at the time, but nobody was operating the lever of the power reverse gear when I turned the air in. The lever was on the center when I started to put the air in. I do not know where it was after the accident because I got hurt and it made me sick and the boys carried me out and took me home. The valve motion of the locomotive dropped down in forward motion when I turned the air in on the power reverse. The valve motion was on center when I got up to place my brake valve and start my air pump. I could not say whether the valve motion of the locomotive was in center position when I reached over. It had never been moved that I know of. On other occasions, in starting up the air on the engine, I have noticed the power reverse [gear] creep a little backward and forward until it got set, without anyone operating the lever. Just a small movement, probably an inch or two, until the air got equalized in the cylinder. The movement took place in the handle and the rods, links, and tumbling shaft of the reverse gear (5182–5186).

CROSS-EXAMINATION

I could not say whether the power reverse was reported defective when the engine came in. I did not look at the sheet. I talked to

the roundhouse foreman and he told me to repair it. I found the defect in testing the engine out. The valve motion dropped
1444 to the forward motion when I turned the air out of the main reservoir into the power reverse. I did not notice where the valve gear was prior to turning on the air, whether it was in center or back motion, or where it was. It was not in the corner. The air had been cut off the power reverse probably all night. Once in a while at the present time I service the same class of engine. The location of the valve where the air is cut into the power reverse has been changed to a more convenient place where you do not have to get back in there to turn them on. I think they have all been changed on that division. I do not know why they made the change; I never asked them. I might have operated the valve without injury to myself if I had shut the air all off and let it all out, killing a lot of time. I could have got up there and opened it up and started the air, and done the work all over again. I do not know whether anyone moved the reverse bar in the cab. It could have been done without my knowledge. When I turned the pump on, I saw the valve motion make one or two short moves. I never knew of anyone being injured by such movements (5186–5189).

REDIRECT EXAMINATION

Such a movement would result in injury if anyone had their hands down in the links.

When my arm was broken I was up on the running board and was not in a position to see anyone in the cab operating the lever of the power reverse.

I was off duty for three months and received compensation in the amount of $250. The company also paid my expenses in the Santa Fe hospital. I was in there three months. I got back a short time after that (5189–5190).

1445 A. R. Rector, 33 years old, testified.

I am employed by the Gulf, Colorado and Santa Fe, a subsidiary of the Atchison, Topeka & Santa Fe. I was first employed as a machinist apprentice about March 1918. I became a machinist about February 7, 1922. I did not go to work immediately because I was laid off on account of reduction in force. I was reemployed on December 9, 1922, and since that time have worked as a machinist and a welder.

On December 12, 1922, I was working in the shops of the Gulf, Colorado & Santa Fe at Temple, Tex. On that day my helper, W. P. Attaway, was injured while working on an engine. He and I had been tightening guide bolts at the back end of the left guide. The engine was no. 3147, initialed A.T.S.F. The engine was equipped with a power reverse gear. I am not positive but I think the make was a Ragonnet. About 30 minutes prior to the accident I had been on the other side of the guide. We took the cotter keys out of

the guide bolts and tightened the guide bolts, and had been to the storeroom after some cotter keys, nuts, or the like, and came back and was applying them. I was leaning over the eccentric rod which hooks on to the bottom of the valve gear, leaning over to apply the cotter keys, and all at once the valve gear gave a quick lunge forward. I looked up through the valve gear and saw that Attaway had his hand caught. The reversing yoke and the reach rod came on to each other and he was caught between those two and the valve gear frame. About that time the valve gear moved backward and released his hand. There was other work being done on that engine. About 30 minutes before the accident I had been on the other side and the back head was off the reverse gear cylinder. I presume they had been putting in packing leather. About four or five months [should be minutes?] after the accident I went over
1446 on the right side and the cylinder head was on. I did not see anyone in the cab of the engine. I do not think this accident would have happened with a hand reverse; first, because we would not be working on the reverse gear, and second, it would not have given any lunge. When we removed the reverse lever, the probability is that it would have given a slow pull and not a quick jerk and Attaway would have had time to see it or [and?] get his hand out of the way. If anything moves about an engine when I am leaning up against it I always move as quick as I can.

I have seen the valve motion move lots of times when no one was in the cab operating the lever. I have seen an engine move when being steamed up, and without air, and no one operating the lever. It moved about 10 feet. I crawled out from the cab and threw chains under the wheels to stop it. The throttle was leaking. If this engine had been equipped with a hand reverse I could have stopped it without throwing chains under the wheels. I could have moved the reverse lever in the opposite direction and if it did not stop then I could have given it a little steam and it would have stopped. If it had been a hand reverse and the throttle was leaking I would have thrown it on center and that would have blocked the valves.

It is part of my duties as machinist in the shop to repair power reverse gears. The most frequent causes of trouble in the power reverse are: creeping, caused from piston packing blowing; and packing leather in the reverse gear cylinder leaking (5190–5196).

CROSS-EXAMINATION

If the engine had been equipped with hand reverse I would have thrown it the opposite way with steam in the cylinders, and when it stopped I could throw it on center and that would block
1447 the valves. I could not do that with a power reverse. I always block the wheels when the engine is brought to the roundhouse, but sometimes the chain is taken out from under the

wheels to move the engine. Once in a great while the chains are left out from under the wheels. No steam can enter the cylinder with the hand reverse on center.

By stating that creeping was the frequent cause of trouble in the power reverse I mean that about every fourth engine I work on that has power reverse gear there will be a report on creeping. On an average I work on from one to five or six engines a day. At the present time there are not so many engines coming into the shop where I work, but I have seen approximately fifty run out of that terminal. When there were fifty engines I worked on approximately five. About one out of four had creeping gears. I do not know whether any of the others in the terminal that day had creeping valves.

In the roundhouse where I work they have two air men. In the daytime, 8 a.m. to 4 p.m., they have two air men who take care of power reverse and all of the air work, but at other times, from 4 p.m. to midnight, and from midnight to 8 a.m., the foreman will assign a man to a certain engine and he will do whatever repairing there is to be done. I was working from 4 p.m. to midnight. I got all the machinist slips on that engine.

I do not know the exact amount of travel that the valve moved when Attaway had his hand caught, but it moved far enough to catch and mash his hand between the valve motion and the valve motion frame. After catching his hand, it moved back instantaneously, in three, four, or five seconds. I looked up and as I did
the valve gear released his hand. I do not know whether
1448 anyone was in the cab or not. Attaway was off duty around
two or three weeks. I do not know who took the head off the power reverse cylinder or who put it back. This shift was, I believe from 8 to 4. I know it was in the day time. I believe we were working ten hours then, but I do not know whether we were working eight or ten hours at that particular time. It was about 8 o'clock in the morning. That is the shift where they have the regular air man doing the power reverse gear work. I saw the air cylinder head off 30 minutes before I began to tighten up the guide bolts, and about five minutes after the accident I went on the other side and the air cylinder head was on. The air men were working on the engine before I was, before the accident occurred. I do not know whether they were there when the accident occurred but they were there before that time. I do not know whether one of the air men got up there and was testing out or moving the gear when Attaway had his hand caught.

With respect to manually reversed engines, I have not noticed that men about the shop and yard give quite a tug on the bar to get them over, because as a general rule when we turn such an engine out of the shop it must work easy or they won't let it out. It must not work too hard (5196–5202).

RICHARD BROWN, a laborer, living at Gallup, New Mexico, and employed by the Santa Fe Railroad, testified:

On February 6, 1925, I was working nighttime, at 2 o'clock in the morning. I started to work to fill up or lubricate the locomotive. I got down on the right-hand side to fill them up with grease, and I was about half way up with my body under the engine, the guide, and I came out and finished up, using one hand on the right-hand side. I could not hear anything on the other side because
1449 the fireman was on the right-hand side and I was then working on the left-hand side, and he started the engine and it caught my arm and broke the bones. I hollered as soon as I could, and he turned me loose. I got out but my arm was broken. When I hollered, the fireman moved the gear back right away. You can reach up there, and the guide was too high for him, but I never heard anything about it, because he was on the right-hand side. I did not hear anything about telling the fireman to release the air brake. I was reaching into the grease cup at the time the reverse gear was moving. I was sticking my arm under the side rod, and you can't hear anything moving. It just came down quick when the air was reversed. The cup I was screwing down is close to the wheels, on the top guide. There are four like this and it was the last one down close to the front wheel of the engine. It was on the inside of the side rod. My arm was near the valve rod, between that and one of the guides. I stayed home seven weeks. I did not lose any pay. They paid me what I got by the day. They paid me $240 for the seven weeks (5202–5204).

WILLIS SMITH, a locomotive engineer for the Santa Fe Railroad, living at Gallup, New Mexico, testified:

I have been a qualified engineer in the employ of the Santa Fe Railroad since about December 1, 1926. I heard the testimony of Mr. Richard Brown and was present on the engine at the time he was injured, February 6, 1925. I was on the engine getting ready to get out of town. We had a short time to get out of town, and, if I ain't mistaken, I was filling the oil can for the engineer, and I heard somebody holler down on the ground. I looked out and there was the engineer with a torch in his
1450 hand, and he came walking around and hollered up and asked me to set the independent brake. He said: "Be sure and see the independent brake is set and raise the reverse lever up." I raised the reverse lever up and I heard somebody holler something, and I let it back. The engineer came up and in about three or four minutes said we had broke a helper's arm. I did not know the fellow at the time, but he said he was one of the fellows working down there. I jumped down to see the fellow but they had carried him off. They said his name was Brown. I did not see him. When I got down to look they had all gone.

The engine was equipped with a Ragonnet power reverse gear. To move the gear I just reached down and got hold of it, you know,

and brought it up as slow as I could to where I wanted to set the engine. I generally want to bring it up toward center, and try to bring it up as steady as a person can, for the engineer to oil. It was in forward motion before I moved it. I moved it as close to the center as I could. I did not notice any obstruction or anything retarding the movement of the lever as I pushed it up to the point where I stopped it. Just about the time I got it stopped I heard somebody holler and I looked out of the window thinking maybe the engineer was hollering to move it to a different place, and at that time it seemed they were on the other side, and then I got hold of it and went to the other side with it, back to the front corner.

CROSS-EXAMINATION

When I moved the hand lever of this power reverse the gear did what I intended it to do. It performed as I expected it to do (5206–5209).

JAMES KIELY, 65 years old, roundhouse foreman for the
1451 Santa Fe Railroad, located at Gallup, New Mexico, testified:

I have been working for 53 years on railroads. On November 21, 1921, I was working at Winslow, Ariz., for the Santa Fe, in the capacity of general foreman. About one or two o'clock in the afternoon engine no. 3240 was being handled by a hostler and I was standing on the next track supervising some work on another locomotive, and a fellow hollered to me and said, "Jim, one of your men has got killed over there." I rushed over the left side of the engine and I saw a fellow reach around and get another fellow by the waist, a fellow named Abbott. I said, "What is the trouble." He said, "Somebody reversed the engine catching him between the valve rod and the top guide." (Objected to as hearsay—objection sustained.) The fellow kind of leaned over with blood running out of his eyes, ears, nose, and mouth. I think it was the inspector who grabbed him, but I do not know. He grabbed him up and put him on a spot engine, which handles engines around the roundhouse, and rolled him down to the hospital.

(Examiner inquires whether there is a report of this accident. Counsel expresses opinion that there is a "Form T" report, but does not think there is any B. of L.I. report.)

At the place where this man was taken out I saw a kind of imprint where his head had catched, between the valve rod and the top guide, where either his cap or hair had cleaned off a spot there. His cap had fallen off. The engine was equipped with a Walscheart valve gear.

They took Abbott to the hospital; they put him on train 21 that night for the Los Angeles Hospital. I understood he died that night. I do not know where the hostler is now. The company tried to locate him sometime after the accident but it seems like

he disappeared and they never could locate him. After the
1452 accident I held an investigation at Winslow. I believe it was that evening. The hostler was there among others. We could not get much out of it. It seemed like the hostler said he looked all around the engine before starting to move it. The accident happened on the left side of the engine and the hostler was on the right side. In the meantime the men were looking after the sand pipes, lubricators, and one thing or another, and they would stick their head in some place to find out something. It seemed that Abbott got his head in there to make some adjustment on a flange or lubricator and they moved the lever and the accident happened. That is what I learned as a result of the investigation.

(No cross-examination.)

Examiner presents sketch to witness and inquires as to what part of machinery had the imprint of Abbott's hair or head. The witness answers: The valve rod here. Attaches to it, or the radius rod. The top guide bar comes right along here. [Indicating.] When you reverse your engine, that rod works up and down. There is a space between the top of this guide and that one, when it is clear in forward back motion of 6½ inches, I think, on the 3160-class engine. This man's head was right in there [indicating] between the radius rod and the top portion of the guide.

(At this point Counsel Morehouse presented report called for by the examiner with respect to Mr. Dalzell's accident on the Union Pacific. The document was received in evidence and marked "Exhibit No. 59, Counsel Morehouse" (5209–5215).

A. CRASE, an engineer, living in Los Angeles, testified:

On July 20, 1920, I was in the employ of the Santa Fe Railroad as a locomotive engineer. On that date I sustained an accidental injury at Barstow. We got over in the yard and coupled
1453 on the baggage cars. There were two trains out there, north no. 9 and south no. 9, and they would always let us back down, and he would back on to the cars, and he would take care of the train which left first. He would take care of south 9 first. As a rule he would stand there until the car inspectors would come up and see if the coupling was made, and so forth, and take care of us. After we had packed up all the cars I got down on the left side to fill the high pressure guide cups and as I put my foot on the bottom rung of the ladder and reached up to get hold of it something on the valve motion came over and caught my hand and I was fast there and could not move. I hollered to somebody to reverse the engine, to pull the lever back, and that was done. The shock was pretty bad and I do not remember much more which happened, only that I was taken over to the hospital and fixed up to go to Los Angeles. The engine was no. 3533. I was off duty two years and four months.

With respect to the injury to my hand, the hand was just hanging a little on the back and cut clean across there [indicating]; there was a dirty glove that I had on and it cut into the hand, and I suppose it was that dirty glove, or something, which caused blood poisoning to set in, and I was in the hospital for four and one-half months in bed before I got out at all, and they could not cut into the hand on account of the blood poisoning, so there was never a bone set all that time, and it knitted the best way it could. They did everything they could to restore the hand. I had, I think, five operations. There was so much dead bone in the hand and the middle finger was shattered so badly, the bones in it, that they had to take it all out. They took off the second finger. As to the use of my hand, that is as far down as I can draw it [indicat-
1454 ing]. Because of the condition of this hand, I have not been in locomotive service since 11 years ago. I have been working as a stationary engineer, power plant for the Santa Fe. The Santa Fe paid me wages all the time I was off at the rate of $300 a month, aggregating about $8,700. As to hospital expenses, we all belong to the hospital association and are taken care of. We pay dues each month. As to the measures taken to save the use of my hand, they did so many things it is hard to remember them all. They even took flesh out of my leg to build up the hand. There was no flesh left here except thin skin and they put some of that flesh down underneath; also in the back of the hand, because the bones were bare [indicating]. These operations were performed from time to time. As soon as it would heal up enough they would operate again. They made every effort they could to get me back on the engine (T. 5215–5220).

CROSS-EXAMINATION

The accident occurred July 20, 1920, I think. I had been running engines equipped with power-reverse for some time prior to that. This was the only occasion when I was injured with power-reverse. The engine was a Pacific type, about 190,000 pounds. Somebody in the cab released the lever after my hand was caught. My hand was caught because somebody was operating the gear. I have only the fireman's word for it. He says he put the lever over. As to whether the same result would have happened with a manual lever on the engine, that was before 1920 and the first power reverse gear we had then was a little bit different than it is now; from
1455 what I hear they have fixed her so that there ain't so much noise. I did not hear anything as it was, but with the old hand levers if the motion was a little bit rattlely, you would probably hear something a whole lot quicker than with the air-reverse, but if it was tight, hard to reverse, it would show up there. He would be slow to reverse (5220–5222).

C. M. WISHAM, a locomotive engineer for the Sante Fe, living at Bakersfield, Calif., testified:

I have been employed as a locomotive fireman and engineer by the Santa Fe. At the present time I am a locomotive engineer for that railroad. I was present here while Mr. Crase testified. I know about the accident. I was in the cab of the engine when the yardmaster or assistant yardmaster, I do not remember which, came over to the deck of the engine or the gangway and asked me if I would not move the engine from the train as they wanted to put another car on. The engine was standing at the depot on the train which had just come in. I went over to the left side; also to the right side of the engine and looked out to see if I could see the engineer, but did not see him. I turned the bell ringer on, and, assuming that he had gone to get his watch registered or a little lunch before leaving, which is the custom, I moved the reverse lever in the back motion to get the engine uncoupled from the train. Then a few seconds probably elapsed before I threw her in forward motion. A blue flag was not on the train or engine. The car inspector said to me: "Throw her over, Wisham; you have got him caught." I immediately throwed in the back motion. My engineer was Mr. Al Crase, who just testified. Immediately following that, he came up to the gangway of the engine and said: "You caught my hand." He hollered up there and was holding his hand. It was crushed pretty badly. That was after I had moved the reverse lever from the backward to the forward position. The engine was equipped with a Ragonnet power reverse. I had moved
1456 the lever the full length of the quadrant from rear to front.

In doing that I did not feel any difference in the operation of the gear from ordinary. I had not noticed that the movement of the operating lever was arrested or slowed up at any time. I believe the engineer was caught on the second movement. I could not state but I imagine that is the way it is because I had to pull it back to release him. It was after the second movement that the car inspector told me I had caught the engineer. As to whether or not the same injury would have resulted if the engine had been equipped with a manually operated type of reverse gear, the injury might not have been so severe, but with a Baker-Billoid gear there is not much clearance when you move it over to the frame where his hand got caught. What I have in mind when I say the injury might not have been so severe is, you could not get it over so quick, and it may not have gone clean to the corner, and you might felt some obstruction. There is not much chance for feeling any obstruction with a power reverse gear with pressure behind it. Even with a hand gear, before you would feel the obstruction of the man's hand the damage woud be done but, as I said, it might not have been so severe; it might not have gone over with such a force as to crush his hand as it did (5222–5226).

CROSS-EXAMINATION

In response to inquiry as to whether the rules of the Santa Fe provided that a blue flag or lantern should be displayed when anyone was working around the engine, witness answered: "They did not supply that for anyone working on the engine, but on the train. The inspector possibly had the blue flag but he had taken it off. I do not know. He understood the movement, and that is what made
1457 me believe Mr. Crase had gone to eat or get his watch registered which was the custom each morning." The blue flag does not apply to an engineer working around the engine, as Mr. Crase was doing. This was in the morning. It was dark. We left there at 3:55 at that time. The time is changed now to 4:25 (5226–5227).

THOMAS E. GALLAGHER, locomotive engineer for the Santa Fe Railway, living at Mojave, Calif., testified:

I was involved in an accident on May 5, 1915. It occurred at Peach Springs, Ariz. I was going up no. 10 and the engine developed a hot pin after I left Needles. The fireman took care of it at Kingman and he again got down to take care of it at Peach Springs. I went around while he was doing that—it was on the left side, the left front side rod pin. When I got done oiling on the right side and went to the left, he was still working on this pin, standing on the ground, and when I went to get up on the engine I hollered to him because they were taking water slowly, and I said: "Rich, I will look after your water." He said: "All right." I got up and when the tank was full, I shut the water off and came down in the cab, and expected him to jump up on the gangway every minute. I walked over and the lever was in the back motion. I started to put her ahead. I got her possibly one-third of the way over and heard a yell from him down on the left side, so I jerked her back and stepped over in the left gangway and saw him lying on the ground about six or eight feet out from the engine. I jumped down there and asked him what had happened. He said: "You caught me when you threw her over." I asked him how badly he was hurt and he did not know, so I tore his clothes open, and he had a number of bad bruises on each side of his chest. I felt around and thought I could feel his ribs kind of cracked. I spoke to him a minute
1458 and said: "I am going to put you in the coach and do not try to fire the engine." He wanted to fire the engine and I said: "You cannot fire her in." I helped him up and walked back there and I put him in the coach and got ahold of the brakeman and we went on into the terminal. He was off duty about ten days.

The engine was no. 3524. It was equipped with a Ragonnet reversing gear. When I was putting this reversing gear over and up to the time I heard him yell, I did not feel any obstruction. It did not operate in any different manner than ordinary. I have handled engines equipped with the hand or manually operated type of re-

versing gear, the Johnson bar type, for about one-half of my railroad career. The latter half, the last 15 or 18 years, has been almost all power, all but a few trips. I have had experience as a railroad engineer since 1892. I am 63 years old. I do not think I would have caught him if the reversing lever had been of the Johnson bar type. I do not think I would have got it over fast enough to catch him (5228–5231).

CROSS-EXAMINATION

In my opinion the power-reverse operates more quickly than the manual-reverse. I could not say whether you can do more switching in a day with a power-reverse than a manual. I have not been on the switch for 30 years. I have had very little switching on the road. All our trains are thru trains. At present, I am in the helper service and we do not do any switching. I have done some switching with power-reverse in the last 18 years. I would not say that I could switch any more cars in a day with power-reverse than with the manual lever. I could do about the same job with one as with the other. So far as putting over the gear is concerned, the power-reverse acts more quickly. We do not have any rule on our
1459 road about ringing the bell before we handle the power-reverse to move it, but before starting a train we have a rule that requires us to ring the bell, but I was not going to start the train at that time. I do not think it would have been the proper thing for me to have rung the bell in this case. The man, when he done that particular job, always stood on the ground, and he was standing on the ground the last time I saw him but for some reason he got up there to get down. I did not see anything. I was on the right side and he was on the left. If I had rung the bell I do not know whether he would have gotten out of the way or not. We never ring the bell when there are only the two of us working around the engine which was the case at that time. I had no occasion to ring the bell at all. I have observed that men on my road, when the bell is rung on the locomotive, still work around it. Had I been at a terminal where there were different men working around the engine or had I reason to believe there were, I certainly would have rung the bell but on this case there was not the situation. When the bell is rung I have observed that some men working around the engine get away and some do not. Some stick around and get pinched.

The reverse lever was in back motion instead of on center because on this particular gear, the Walscheart gear, in order to oil them and do a good job, and make it easy to get at, you put her in the back motion so you can get at all the holes and oil them. If you leave her in the front motion there are two or three places that you have to crawl in to oil and you would probably miss them and they would not be where you could get at them. That is the reason we always put them in the back motion when oiling around. I knew the man was down there when I put the lever ahead.

1460 I did not look out but I saw him a minute before when I got up on the engine and he was on the ground. I did not give him any warning that I was going to move the gear.

The hot pin was on the left front side rod. There was nothing unusual about the way the gear acted. I have never felt any obstruction in the valve motion when handling a manual reverse. This engine was equipped with a power reverse. I could not say what she would do with the manual reverse.

REDIRECT EXAMINATION

As between the power gear and the hand gear, the power reverse moves the valve motion the quickest. It acts quicker than the hand reverse. It has the power behind it (5231–5235).

L. W. ARNOLD, 36 years old, fireman for the Nashville, Chattanooga & St. Louis Railway, testified.

I was first employed as fireman by the Nashville, Chattanooga & St. Louis Railway in 1918. I have not been promoted. On April 11, 1928, I got fastened between the main air drum and the radius bar. This happened at Bruceton, Tenn. The engine was no. 625. It was equipped with a Ragonnet power reverse. We were called for no. 55 out of Bruceton about 1:30 a.m. We had got our engine ready, the engineer and myself, and we were both sitting in the cab when I remarked: "What are we waiting on"? He said: "We are waiting for a car off no. 9." We called it the "pig." We sat there a few minutes then the engineer remarked: "Arnold, I have an air leak which I wish you would find." I said:

"All right." I lit the torch and began to trace around on the
1461 brake valve and he said: "I have already looked here—there is no use looking here." I got down on the ground and traced it to the main air drum. I did not find any blow. The engineer got off the engine and walked along behind me, tracing with his torch. After I did not find it in the main air drum, I thought I would walk back and retrace it. I thought maybe I had missed it. He walked by me and said he could not imagine where it could be. After I traced it back to the main air drum and did not find it, I worked up to the brake cylinder, hearing this blow. The engineer walked around on the left side of the engine and I could see him by his torch and I asked him if he had found anything. He said: "No." I heard a little blow around the brake cylinder and pulled the glove off my hand. I put it next to the brake cylinder and felt the air blow. I put my foot on the guide and reached up over the frame and was undertaking to put my torch to this blow to see how bad it was and just as I did that something hit me and mashed me up against the main air drum. I did not know anything; it knocked the breath out of me. When I came to myself, the engine was backing down the track. The radius bar hit me. I was fas-

tened between the radius bar and the main air drum and held there. I was on the right side of the engine. The brake cylinder is up under the boiler where the saddle is in between the frame. The engineer did not stop the engine but went on an engine length or a few feet farther before he heard me holler. There was a nigger porter going to the depot from the wash house and he had a flash light. He heard me holler and he flashed his light on the engine and saw me hanging in there. He signed the engineer down as quickly as he could and of course the engineer stopped the engine as soon as he could. After I got well I made a test of that engine as to clearances. I did not put a scale to it, but in my judgment, it is about 10 inches. It was then in the position which caught me.

1462 I knew it was pretty close to the air drum. It pressed me so tight that I could not move until he reversed it in forward motion and let me out. While I was up there looking for this leak, he put her in back motion and backed on down the track; that is what happened. It injured my back. It tore the ligaments and the muscles of the back and sides. I was off duty 12 days, during which I received full pay, $6.12 a day or a total of about $74. The doctor and hospital bills were also paid (5236–5240).

CROSS-EXAMINATION

The bell was not rung before the engine moved, I did not hear it. I got no warning from the engineer at all that he was going to move the engine. He knew I was on the ground. I was caught just below the chest, below the breast bone right in here [indicating]. It pressed me down to about 8 inches. The reason I was in the position where I was caught was because the engineer asked me to find this leak and I tho't it was my duty to look for it and find it. There was a blow around the brake cylinder. That is where I found it. There was plenty of space when the reversing lever was in center for anybody to get up over the radius bar but when he reversed it, the radius bar raised. I have been on this engine since that time. It still has the power reverse gear. It was a big engine but I forget the capacity. It was no. 625 L–1 class (5240–42).

W. H. CHERRY, 56 years old, testified.

I am employed by the Nashville, Chattanooga & St. Louis Railway. I was employed by that road on March 19, 1900 as locomotive fireman. I was promoted in 1910. I have had experience with both hand and power reverse equipped engines. I guess my experience would be about as much with one as with the other. It is about fifty-fifty. I have never been injured nor have I ever seen anybody else injured with a hand reverse. I was injured with a power reverse on

1463 December 24, 1924, at Bruceton, Tenn. The engine was no. 504. It was equipped with a Ragonnet power reverse. I was the engineer on that occasion.

We change engines at Bruceton, Tenn., running from Nashville to Hickman, Ky. We changed engines at Bruceton, going down, and the crew from Paducah, Ky., to Memphis, Tenn., gets the train out of Nashville and you get the train out of Paducah. You go to Hickman and he goes to Memphis and you change coming back. Coming back, I had no 254 and was to exchange this for no. 504. He placed the engine there and was taking water and I oiled the right side of the engine around when we were standing there. When I got thru oiling the right side I moved the bell and was going up to clean the fire in order to have room to get started and I crossed over on the left side of the engine and stepped back out of the way until he walked up, and I had oiled all the left side of the engine except the front driving box, when the fireman reversed the engine. I had the torch in my left hand and was holding it up so that I could see how to oil the driving box wedges, the left front driving box. I placed my hand over the radius bar between the radius bar and the link frame. The fireman reversed the engine while I had my hand in there and took my arm off. It caught me about 4 inches below the elbow and forearm, about midway. I was caught between the radius bar and the link frame. The link sets in a stationary frame. This engine had a Walscheart valve arrangement. The fireman knew that I had been caught because one of the men there heard me holler and ran to the cab and told him to throw the lever back. The arm was crushed so badly they had to amputate it. I was in the hospital 21 days, and they placed me on the pension. I was on a pension for five years. At present I am station master at Atlanta, Ga. I received $3,500 compensation and an artificial arm. I have seen the valve motion move on a power reverse equipped
1464 engine without anyone in the cab. The engine would be standing still; probably, I would be oiling around and I would notice the radius bar raise and lower. That is occasioned by the packing leather leaking (5242–5246).

CROSS-EXAMINATION

It would occur when the engine was charged up. If the packing leathers are leaking that allows power on the opposite side from the spring to weaken and, of course, the spring shoves the radius bar down. I think that is the only occasion on which I have seen the gear moving without anyone in the cab. I suppose there was 6½ or 7 inches clearance at the place where my arm was caught. When the gear was moved the radius bar came clear up through the link frame. If the engine had been reversed with a manual bar, the link motion would not have moved as quickly as with a power-reverse, or with the crash that it did, but if reversed by hand it would go to the same position it did when I was caught. The power-reverse operates the valve motion more quickly than the manual reverse and it takes less time to draw the engine from backward to forward

motion with power-reverse. The bell was not rung before the gear was moved and I was not warned in any way. The fireman heard me holler I was hurt; came down off the engine crying and said: "Mr. Cherry, I would not have hurt you for all the world." I said, "Don't worry about it. It is all over." He said, "I thought you were in the office." I do not know why the fireman moved the lever. I did not see the engine any more for a year or more. When I did, it was still equipped with the power reverse gear (5246–5249).

1465 W. S. HAILEY, 50 years old, employed by the Nashville, Chattanooga & St. Louis Railway, testified:

I was employed as a telegraph operator in 1899 and as a fireman in February 1902. I was promoted and made my first trip in December 1911. On May 13, 1930, I got my back hurt in Nashville, Tenn. It was between 8 and 9 o'clock in the morning. The engine was no. 605. It was equipped with a Ragonnet power reverse. I was going into Nashivlle and there was something broke about the reversing gear about 4 miles from Nashville at the foot of a hill. I did not stop. I went on into the yard and the track I pulled in would not hold my train. The yardmaster wanted me to double over but I stopped before getting out of the clear and got down to see what was wrong and the piston rod of the reverse cylinder was broke. It looked like it had pulled out of the crosshead at the back end of the reach rod and there was about 6 or 8 inches sticking out of the cylinder, a ragged break, and I came to the conclusion that the piston rod was broke off and gone. It looked like it was pulled out of the crosshead and I thot it was pulled from the back. In other words, I was fooled by it. I told the yardmaster that I could not double over. I cut the engine off and let him pull me with a switch engine and I told him I would reverse the engine—which I did. I got the shaker bar and pressed up on the radius rod. That was after we pulled up and he shoved me back on another track. After we stopped I got the shaker bar. I pressed up on the radius bar and had the link block at about center of the link and could not shove any farther and had the fireman get a coal pick and hold it and as I got the block to the center of the link that piston shot out of the cylinder and hit what I was holding up and
1466 the doctor said it tore the ligaments loose in my back. I do not know what it done. I was off about 30 days. As compensation I was paid the mileage my train made while I was off. It was something around $200. The company paid my doctor and hospital bills. In my opinion, the accident could not have happened with a hand reverse. It was reversing the air in the cylinder which caused it (5249–52).

CROSS-EXAMINATION

I had not shut off the air supply to the power reverse cylinder. I was misled, in fact, I did not think of that. If I had done that and drained the cylinder it would not have acted that way. This

is the only accident I have ever had with power-reverse. Practically all of our engines are equipped with power-reverse. I do not know when I used the first one. In recent years that is all I have had. The power-reverse is still on that engine (5253).

M. A. BLACK, 35 years old, a fireman on the Maine Central, testified:

I was employed as fireman on January 3, 1918. I have not been promoted. On April 7, 1918, the engineer on the locomotive on which I was the fireman had his arm broken. The accident happened at 12:55 p.m., at Deering Junction, leaving the Portland terminal on engine 618. The engineer's name was Brawn. We were going from Portland to Bangor. We stopped at Deering for the board signal. The engineer got out to oil the air-reverse. It was a Ragonne't. He told me they wanted to split the crossing, so I tried to go ahead, but I was unable to do so, and he says that they wanted the pin. So I reversed the engine and gave them the slack and then he said: "Go ahead", and I threw the reverse
1467 lever over and caught his arm and broke it. He was on the running board. He knew that I backed up to get the slack, because he told me to do it; then he told me to go ahead. That was when he was caught when I threw it over. I did not feel any obstruction when I caught his arm (5253–5256).

(Motion by counsel for complainants to strike out testimony of Witness Black as not being connected up to the power-reverse, denied.)

CROSS-EXAMINATION

The engineer was caught between the combination lever on the reverse gear and the running board. I did not exactly see where he was caught but he was out on the running board. I saw him when he was caught. I was looking out and he had his arm down by the lever there. He got his arm out himself. He died a while after that of the flu. I have seen this engine since that time. It has the Alco reverse now, I think. There are hardly any Ragonnets there (5256–57).

T. B. REDDIX was recalled as a witness and testified further:

"I have with me at this time the original work reports on the class O engines of the Wabash from the Decatur roundhouse for certain periods of time.

"By COUNSEL:

"These are original reports asked for on those engines and they are done up here in packages for each month, beginning with October 1930. I do not want to file those as exhibits but I am producing them here and will turn them over to counsel for complainants and will ask the witness to state at this time what summary or compilation he has made from these original reports."

"Witness REDDIX (continuing). I have personally checked each work report made at the Decatur terminal on the O–1 engines for October, November, and December 1930 and January and
1468 February 1931 and made a summary of the defects reported on power reverse gears. I have such exhibits with me. I also have exhibits setting forth the dates when these O–1 engines were placed in service."

(An exhibit showing such dates was presented and marked for identification as "Exhibit No. 60, Witness Reddix.")

"WITNESS (continuing). The O and O–1 engines are the same. Those engines were received new from the manufacturer, equipped with the Alco power reverse, and first placed in service on the Wabash on the respective dates shown on exhibit no. 60. That series of engines, numbered 2900 to 2917, include all of the class O engines that have been placed in service running in and out of Decatur up to the present time."

(The document above mentioned was received in evidence as "Exhibit No. 60, Witness Reddix.")

1469 (Statement of "Mileage Made by the 2900 Series or O–1" presented and marked Exhibit No. 61.)

"By WITNESS:

"This shows the mileage for each month September to February, inclusive, made by the O–1 engines. With respect to Engine 2917 where no mileage is shown prior to December or subsequent to January, this engine was put into service and broken in but was not needed and was placed in white lead and has been so since."

(Exhibit no. 61 offered in evidence and objected to as irrelevant.)

"By WITNESS (answering questions of examiner):

"All of these locomotives have been engaged in the same class of service—road freight service—between Decatur, Ill., and Montpelier, Ohio, and Decatur and Brooklyn, Ill. (exhibit no. 61, received in evidence)."

(Statement presented and marked "Exhibit No. 62.")

"By WITNESS:

"This shows the defects reported on the power reverse gears on the class O–1 engines for the months of October and November 1930."

(Additional statements of the same character presented containing summaries of the work reports on the Class O engine for December 1930 and January and February 1931 and marked "Exhibits Nos. 63, 64, and 65, respectively.")

"By WITNESS:

"These exhibits, under the heading 'Notation Made by Engineer', show the actual report made by the engineer on his original work report. These summaries contain only the reports made by the engineer with respect to the power reverse gears, and in con-

nection with each report I have shown the name of the engineer, the date, the engine number and the name of the mechanic who made the repairs. The name of one Augustine that appears frequently represents the man of whom I spoke in my previous testimony as
putting in all of his time on power reverse gear repairs. He
1470 is the man who is assigned regularly to this work on the day
shift at the Decatur roundhouse. The name of the other repair men are machinists who are engaged in any kind of repairs around the shop. (Exhibits Nos. 62 to 65, inclusive, offered in evidence. Upon request of counsel for complainants ruling as to receipt of exhibits reserved.)"

"By Counsel MOREHOUSE:

"I would like to have the record show that we have the original reports here and hand them over to counsel now, and will ask that when he is through examining them that he return them to Mr. Geo. Coutant, Assistant Superintendent of Motive Power, Wabash Railroad, Decatur, Ill."

"By WITNESS:

"These work reports just show what repairs were made. With respect to exhibit no. 65, which is the summary for February, I made a further check with respect to that month. In checking from the carbon copies of the inspectors' work reports I found five reports on defects that were not shown on the engineer's work reports. Those five are not shown on exhibit 65. In my previous testimony I stated that type E was the latest type of Alco power reverse gear. That is an error. Type G is the latest. Class O locomotives have type "G" 5258–5266)."

CROSS-EXAMINATION OF WITNESS REDDIX

(At this point counsel for complainants objected to the receipt in evidence of exhibits 62, 63, 64, and 65, mainly on the ground, among others, that as to witness Reddix these reports are mainly hearsay. After considerable discussion between counsel for the parties, the examiner and the witness, htwersictep
examiner and the witness, with respect to the work reports from which exhibits were compiled, exhibits nos. 62 to 65, inclusive, were received in evidence, to which an exception was noted by counsel
for complainants.)

1471 (In connection with exhibit no. 64 witness was directed to read the report dated January 4, 1931, on engine no. 2905. Report read as follows: "Pack top valve to lubricator in cab. Right no. 2 driving box pounding bad. Examine reversing gear. Engine creeping bad. Key up rods. Examine all grease cellars. Both main pins warm.")

From my experience as a mechanical man I would not say that it is likely if an engine which has those items reported on it creeps,

then that creeping is due to the pounding in the driving box and the wear on the main pins. The report did not say that the main pins are worn. It says it is warm. The main box pounding would not make the reverse gear creep. From my mechanical experience in connection with what I have been taught as to the working of an engine, the repairs to an engine, I do not see how it could make it creep. If an engine needs the rods keyed up on it that would not make the gear creep. These engines have the Walscheart valve motion. Loose wedges reported on engine no. 2905 would not make the power reverse creep. There is nothing listed in the several work reports for this engine which would have a tendency to make the power reverse gear creep. The fact that a repair item is repeated with respect to a particular engine does not mean that repairs were not previously made. The reverse gears could have been repaired each time they were reported and still have repeated reports on succeeding days. I have not observed any case at our terminal where an engineer reported creeping power reverse and the shopman did not make the repairs on the day reported but let them go. We make the repairs when they make the reports. I have never observed a case at our terminal where an item has been reported and the shopman has written his name on the report without doing any work. They know better than to do that. If they did they would be taken out of the service. We have never taken any out of service
1472 for that. They do not do it. I did not say that the repairs which were requested on various dates in January with respect to these engines were not made properly until the last date. They were made properly on every date on the power reverse gear. The fact that on the last date we had two mechanics working on the engine instead of one was because of a change in shift. It would have to be. We certainly would not call a man in to help the other fellow out. Augustine and Fitzgerald could have been changing shifts, or it could have been we sent a man down to help out. We have those things occur right along. I do not know whether this trouble of creeping was cured with the last repair in January. I never check this specific engine. I see it was reported again on exhibit 65, to pack the air reverse gear piston—one of them—and air pipe leaking on the other side. It does not say anything about creeping on exhibit no. 65, but packing the air reverse gear piston only means that that reverse gear is creeping or you would not want it packed. A leak around the air reverse piston, however, will cause creeping. The engineer should certainly know it and should report this, or any defect that he observes on the locomotive while in his charge. The least bit of creeping should be reported. Any defect whatsoever, regardless of how large or how small, should be reported. When we get a leak in the roundhouse we repair it with a report on it because we know that a leak will develop creeping. You have an equalized pressure in that gear and if you reduce the pressure on one end it is only logical that the gear will move in the direction that the pres-

sure is reduced. A small leak will cause it to move. It should be an equal pressure on each side of anything; and if you reduce it on the other side it is bound to move toward the reduction of the pressure.

1473 From a mechanical standpoint I would say that it would move the gear enough to bother the performance of the engine (5267–5280).

(Upon request of counsel for complainants witness reads items reported on February 1 and 3 for engine 2900, as shown on exhibit 65, as follows: For February 1, "key up front end of main rods. Branch pipe leaking at right boiler, check. Reverse gear floats bad." For February 3, "main throttle stuck open. Reverse lever creeps bad. Both of these items were reported at Montpelier. Butt end of main rods pound bad. Both main boxes pounding. Clean out sanders.") I would say that on the dates listed that engine moved from Decatur to Montpelier and back; that it was reported at Decatur on the 1st floating bad; and then was reported at Montpelier for creeping. The work report of this engineer showed that it was reported at Montpelier, which might have been on the 2nd—I don't know. I do not know what date the engine was in Montpelier. It was reported again at Decatur on the 3rd. I would say that repairs were made and other defects developed which is very likely and which does happen on this gear. Whenever work is reported at Decatur it is done. They could have made the proper repairs at Montpelier and other defects developed on the gear from Montpelier to Decatur. We make proper repairs, the necessary repairs, on all work reports. By necessary repairs I mean it is always necessary to perform some work on all items that are reported, and we always do it. We do first-class work at our terminal. We don't give it the once-over. You cannot maintain power in proper condition if you do that.

With respect to the items shown for the month of October. On exhibit no. 62, I would not say that these items indicated that the reverse gears were new and that the hand-operating lever in the cab

1474 was a little too snug for the engineer to operate. There are different things that would enter into that. There is one trouble that we had with that very item that I happen to know that was in the operating valve which necessitated the taking of that valve off the engine and going through it to overcome that trouble.

These class O engines are still in service but not on the division where I am now. They have not come under my supervision since June 15. I do not know whether they are still having as much trouble with the gears of the O engines as when these reports were made because I have not been in conversation with anyone about them. When I left there in June we were having trouble. I would not say just how many reports but we were still having trouble with them. This trouble was not due to the newness of the gears. There should not be any adjustment necessary on this power reverse gear when it is put up, after it is put up. At times it is necessary

for adjustments in the valve motion of the locomotive for the simple reason that many valves on the locomotive—they can vary for various reasons, but on this reverse gear this gear is assembled to a print and it is sent to you by the works to put on the engine. The only adjustment we make when we put it on is the length of the reach-rod. With respect to locomotive motion, some of the levers are put on in accordance with the blueprint. After the engines are in service it is necessary to set up the wedges and key up the rods. After they are in service two or three months you will have pounding in the boxes on that type of locomotive because it is a large locomotive. There is no more strain on the valve gear on this than on any other locomotive. You will have pounding in the boxes on any of them. The bearings start to wear when the locomotive is put in service. If a man is working his engine in too short a cut-off it will pound. If his reverse gear is floating that will
1475 cause it to pound. Some men have report after report on pounding. Even when properly repaired, after they are first repaired, some men will report pounding again on the same trip or the next trip, because such is the case. We have our limits as to when to drop a set of drivers and our limits as to when to renew a set of driving boxes; and also as to pounds on our back end main rods, but we never let them get that far. With respect to reports turned in on these 18 new engines as to pounding, they should have had a pound there surely; but it would not have been pound enough to drop a set of drivers or to renew a set of driving boxes.

Engine no. 2905 was reported as pounding at the Decatur roundhouse on January 4, 10, 18, and 23, 1931. The proper repairs were made to these items even though the engine would pound again on the next trip. There is no reason why those defects could not develop. We work on them every time they come in. The Government allowance on pounding in the boxes at the back end of the main rod is 3/32 of an inch (5280–5288).

REDIRECT EXAMINATION

The creeping of the power reverse gear reported on engine 2905 may have developed the pounding also reported in the driving boxes and rod bearings, due to unequal steam distribution. The power reverse gear in short cutoff starting to creep, the reverse lever will naturally work down and work back. In some instances where it is creeping badly it will work back far enough to go past center in back motion, which would throw an undue strain on all of the valve motion parts, rods and boxes, and cause them to pound. Pounds can be developed from excessive wear, and also in this case of an unequal steam distribution, it will cause an engine to pound in the boxes, and while the wear will not be excessive as to the opera-
1476 tion of the engine due to the undue strain that is thrown on these parts it will cause it to pound, which is commonly known

among the shopmen and the enginemen as a steam pound. After this condition is corrected and the engine operates properly you will not get that pound. Engine no. 2905 went into service on October 9, 1930. The first report on the creeping of the reverse gear was November 4, 1930. A similar report on creeping was made on November 30, 1930 (R. 5290). There were no reports on creeping on engine no. 2905 during the entire month of December. The defect reported as "roller gone from guide to reach rod back of reverse gear" could cause the gear to creep if there were enough lost motion in the reach rod to cause sufficient vibration. In January there were six reports on the same engine. A new gear should not creep at all. It is supposed to be put up as nearly perfect as it can be. Nevertheless, a new gear does creep. The reason we have to work on this gear repeatedly and at close intervals was due to the defects that developed on each trip. We had creeping trouble before we got the class "O" engines.

RECROSS-EXAMINATION

I have never made any recommendation against putting power reverse on new power or any other power. I cannot account for the fact that 6 repairs were made on engine 2905 during January 1931, while no defects were reported during February although the engine was in regular service. I have no way of telling when a device like that is going to become defective. It does not have to be improper repairs for this defect to develop again. You can make the proper repairs, send the locomotive out, and the defects develop. If every time you repaired a locomotive there would never be another defect reported on it they could close down the shop.

1477 On some different things the repairs will stay much better than others. We have some things that are repaired and repaired properly and then go out and they will come back defective. We do not have many of these, relatively speaking, but this power reverse gear is one of the things that has those defects. I could name some other things that are on locomotives that are extras just like that that give you trouble. But power reverse is one of the worst offenders. That is due to the difficulty of keeping the thing airtight at all points and keeping the lost motion out of it. Some power reverse gears will probably run for a couple of months without any trouble whatever. I never checked them up closely enough to know just how they are running. It is not a matter of maintenance with power reverse. You could put all the maintenance on them that you want to but they could still float. I do not know of my own knowledge what work was done on specific engines. I know some repairs that were made on this engine (2905?). I would not say just what actual work they did on engine no. 2905. We make necessary repairs at our terminal on all work that is reported. I was general foreman there 3½ years. What I mean by necessary repairs, if it was really absolutely necessary the engines would be

held. There is work reported on some different jobs, that although there is an indication on them, we do not consider it necessary to tear the engine altogether to pieces. I have had no case where the mechanic signed as having made the repairs and it developed later that he had not made them or had not made them properly. We have had jobs that have been done that we have caught that were not a hundred percent jobs on some work. I would not tell you that we do not have a mechanic that never made a mistake because they do make them. In my 3½ years I have not had any case
1478 where the mechanic signed for making repairs and had not made them at all unless in this way, that it was a job like these main driving box poundings and a man would come down and adjust the wedge and he would sign for that job. Some of our men would put on the report "set up wedges", and just sign his name to it. But the supervisor always takes care of those conditions, that is, to see that they are in serviceable condition. We could not drop all of the wheels or take down all of the rods that the enginemen report, and even other jobs like that. But on these power-reverse gears we do make a special effort to keep them in shape. It is the same way with injectors and lubricators. When there is something reported on them you always know there is something wrong when you get down to fix it. You do not take it for anything else because they are very important.

I have been testifying about Alco gears. The design of this reversing mechanism is such that even in perfect condition the piston might move a little. There is a cushion there. How much it would move I do not know if it was in perfect condition, that is, under operating conditions. I never ran a locomotive and went out on the running board to watch it. I am a mechanical man. I would have to go out there and look at it to know whether it would move under perfect conditions. It is designed to form a cushion for the link motion but not to move. I do not know whether or not there are air cushions where there would not be a movement. I am not schooled enough in this matter to know whether that condition is going to exist. I do know that the air reverse is designed to form a cushion for the gear, for the valve gear. It is not supposed to float. If it moves at all it floats. Air pressure should hold the piston rigid to the extent that the piston would not move in and out. I
1479 would not say that this would defeat the cushion purpose just because it did not let it move enough to make the gear float. It might move $\frac{1}{16}$ of an inch. If it did that would cushion it. If the air pressure was great enough to hold the piston as solid as a piece of steel, it would defeat the cushion idea. I do not know whether or not it has been designed so that it will move a little. I could not tell whether the creeping referred to in these reports has been sufficient to interfere with train operations. I am not an engineer. I did not run the engine. I have not ridden any of these class O engines with creeping gears. I do not know whether trains

have been delayed on account of the creeping that has been reported. I was not there. I was in the roundhouse. Some engineers are much closer on reporting pounds than others. They should report a very small creeping. I cannot say whether they should be reported every day. I do not run the engines. I could not tell you whether the piston of an air reverse gear is moving all the time that the locomotive is in operation. I never watched one. I would have to see it. With respect to the fire boxes on these class of engines, they have a grate area of 96 feet. The cabs are of the vestibule type. The clearance outside of the cab outside the boiler-head is very close. You could not put a hand reverse gear on these engines from the point of design. The power reverse gear should be used on these engines unless the design is changed (5288–5303).

(Witness excused.)

1480 A. E. VON BERGEN, living at Chicago, Ill., testified:

I have been in the employ of the Illinois Central System for 30 years. Beginning in 1901 I served three years as a locomotive fireman, 14 years as locomotive engineer, four years as traveling engineer, one year as lubrication engineer, one year as air-brake, lubrication, and car-heating engineer, and the remaining or last seven years in my present position as general air-brake, lubrication, and car-heating engineer. In my present position I exercise general supervision over maintenance and operation of air brakes, lubrication, car heating, stokers, feed-water heaters, power reverse gears, and all other pneumatically operated appurtenances on locomotives on the entire Illinois Central Railroad System.

I fired a locomotive on the Mississippi division between Memphis, Tenn., and Canton, Miss. My first year as locomotive engineer was on the same division, then I transferred to the Memphis division, between Memphis and Gwin, Miss., and Memphis and Cleveland, Miss. I was in the passenger, freight, and switching service; probably 85 percent was in through-freight service. The locomotives on which I worked were equipped with manual reverse gears. During the four years I was traveling engineer I frequently observed the operation of manual reverse gears. I was continuously riding in cabs of locomotives from 8 to 16 hours a day, supervising work of engineers and firemen. In nearly all cases I operated the locomotive part of the time. I had a total of about 21 years of daily experience observing and handling manual reverse levers.

The types of locomotives on which I had this experience were passenger locomotives with weights on drivers ranging from 36,300 to 154,000 pounds, and tractive effort from 14,739 to 33,150; freight engines with weight on drivers ranging from 80,000 to 200,900
1481 pounds, and tractive effort from 17,547, to 39,180; and on switching locomotives with weights on drivers ranging from 84,000 to 142,000 pounds, and tractive effort from 19,440 to 31,287. All of these locomotives are not still equipped with manual reverse

levers. Many of them have been retired. Of those remaining in service, passenger engines, weight on drivers 113,000 pounds or more and tractive power more than 21,000; freight engines, weight on drivers 155,450 or more and tractive power more than 23,299; switch engines, weight on drivers 142,000 or more and tractive power more than 25,811, have been equipped with power reverse gears. These replacements were made for the convenience of the engineers on the larger locomotives. Also cab clearances on our large locomotives do not accommodate manual reverse levers.

The reason why power reverse gears have not been applied to all of the locomotives is: On May 1, 1931, there were 1,727 locomotives on the Illinois Central, excluding 34 set aside for retirement and 8 turntable locomotives. Of these 1,540 are equipped with power reverse gears. This leaves 187 with manual reverse gears; 15 of these were programmed for power-reverse, leaving 172 which we have never proposed to equip because they are small locomotives on which reverse levers are easily handled, or locomotives which will be retired within a few years and as to which the expense of equipping with power gears is entirely unwarranted. Of the 172 that are hand operated there are very few in service right at the present time. Because of the business depression they are not needed. They have been set aside in serviceable condition. This program was established about seven or eight years ago by former general superintendent of motive power, R. W. Bell. There is nothing being done on this program at present on account of the business depression. The locomotives which have been set aside are not needed at the present time.

Practically all the locomotives in service on the Illinois Cen-
1482 tral at the present time are equipped with power-reverse.

With respect to the 15 slated to be equipped they are the remnants of the program referred to. Whether we shall go ahead with those at some time in the future depends upon business conditions. If business conditions become normal, and if all those engines are placed back in service and it is expected to use them for quite a number of years, so far as I know, the program might be renewed. It has not been cancelled for the time being, as far as I know. However, I doubt very much if it will ever be carried out because those engines are practically all small and if they are ever placed back in service it will only be for a short time. As conditions look now I do not see any reason for resuming that schedule on the remaining 15. Personally I would not equip any of those 15 engines with power reverse gear because I am convinced that they do not need it. In fact there are a lot of smaller ones already equipped which I would not have equipped. However, I do not think that any hard and fast rule could be established for selecting engines to be equipped with power reverse gears. There are various factors that enter into it. We have locomotives which we equipped with power reverse gears that I thought was correct and proper to so equip because of the inconvenience of the hand reverse levers that were on them at that

time. I have in mind a class of engine where the length of lever required in order to provide proper purchase or leverage for reversing the engine when they were placed in back motion was such that the reverse lever projected back into the gangway. On those engines I think it was right and proper to equip them with power reverse. On the other hand, we had engines considerably heavier than those on the drivers which I personally operated for a number of years that I did not experience any difficulty with at all, with the power reverse (hand reverse?) lever.

1483 Clearance is one factor to be considered, and design is another. In my opinion, the decision should rest upon the design of the particular class of locomotive that is under consideration, such as cab clearance, the distance from boiler head to back of cab or the clearance between the reverse lever and the side of the cab for the engineer. Insofar as weight on drivers is concerned I don't know of any simple locomotive, two-cylinder locomotive, that if the cab clearance permitted, that a manual reverse lever would not be entirely practical and work no hardship on the engineer. So far as large locomotives, like the multiple-cylinder locomotives, the Mallets, are concerned, possibly the power reverse gear would be an absolute necessity. I cannot say from personal experience for the reason that we always had power reverse on our locomotives. But I judge that from the fact that there are two sets of valve motion and four valves to move, consequently making more parts to move at the same time (5304–5311).

With respect to the clearance between the fire box and the outside of the cab I have in mind locomotives where the clearance between the side of the boiler and the side of the cab was such that if the reverse lever was placed on the side of the boiler if it were placed in back motion, it would almost strike the engineer in his breast. If you take the reverse lever on that same locomotive and set it there back of the boiler head to the left of the engineer to give him sufficient clearance even then as I said it would project back into the gangway when he put the reverse lever in back motion. In order to get lever back into the second position we found it would also be necessary to offset the connection between the lever and the reach-rod along the outside of the boiler. We had to apply a fork to the side of the lever making it project at an angle of approximately 45 degrees so as to clear the side of the fire box and connect the reach-rod to this fork and that brings into play additional parts and

1484 weights. With respect to the different sizes of passenger and freight locomotives that were to be equipped under this program I do not know that the program was laid out on the weight on the drivers. I merely gave the weights so that you would have an idea as to the size of these locomotives. I don't know of any reason why the weight should be used for applying the power reverse gear. With respect to the size of the locomotives used in road service and in yard service we have some yard locomotives where the cab condi-

tions are such that they would not accommodate manual reverse levers. As to engines equipped with the hand gear which might be satisfactory for road service but not for yard service the only ones I know of are those I described in which the reverse lever projected back in the cab. You could get along with those on the road, in fact I ran them myself for a number of years and did not experience any difficulty but if you have constant switching to do, it would be awkward because you have to go past the rear of the cab. There is a backboard, so-called, at the rear of the cab and the locomotives I have been speaking of were so equipped. With respect to the awkwardness in connection with throwing the lever to complete reverse position the design of the cab and the location of the seat box was such that a man could not turn and face the rear. If he could have done that he could then have pushed the reverse lever back of the backboard. Because of having to face the front and pull the lever back so far past him it made it difficult and awkward and inconvenient to bring the lever back that far.

(Question as to whether the power reverse gears placed on the 1540 locomotives previously mentioned were installed as a safety device objected to by counsel for complainants. Objection sustained on the ground that witness was not qualified to answer.)

In my opinion the application of power reverse gears to the locomotives on our line that were previously equipped with
1485 hand reverse gears has not tended to promote safety in the operation of those locomotives. In some cases I think it has detracted from the safety of operation. In my experience in handling manual reverse gears I have operated locomotives with hard hand-handling reverse levers, but this was an infrequent occurrence. I do not recall ever having to call for assistance to handle a manual reverse lever. I was never injured nor did I ever see anyone else injured by hand reverse lever. I never injured anyone else or damaged any property on account of giving attention to the reverse lever.

On locomotives just out of shop with general repairs hard-handling levers are usually due to some part of reverse mechanism binding, valve gear pins too tight a fit in bushings or valves and rings too tight a fit in valve bushings. In such cases I located the binding or tight fits, and either relieved them myself or if unable to do so had it done by shop forces. On locomotives in service when hard handling was due to lack of lubrication of reverse or valve gear parts, I cleaned out oil holes and thoroughly oiled them. If due to dry valves I increased oil feeds, eased off throttle, reduced speed if necessary to enable me to place lever at or near full stroke, and this always promptly overcame the trouble. I have had a reverse lever unlatch itself and drop to full stroke forward position a few times. This was caused by notches in quadrant or dog worn so lost motion between dog and notch permitted excessive vibration of dog in notch resulting in its climbing out of the notch. Also foaming boilers washing lubrication off valves, causing excessive pull on re-

verse lever. To take care of worn latch until I reached terminal I wedged the latch handle with a block of wood or monkey wrench and reported repairs necessary on arrival at terminal. To take care of foaming condition I did the same as explained with dry valves and in addition operated blow-off cocks until foaming stopped.

1486 I was never troubled with foaming boilers when locomotive was in my charge exclusively after a washout, as I began using blow-off cocks before foaming started and thus prevented it from beginning. On a few occasions I have had a reverse lever jerk away from me, and for the same reasons I explained when lever latch worked out and lever dropped to full stroke position the remedy I applied was the same. I never experienced any danger to myself or others on these occasions. My position in the cab was such that there was no possibility of danger from the reverse lever. Operating a manual reverse lever has never prevented me from keeping a proper look-out for all signals and highway and railway crossings or obstructions on the track. During my 21 years' experience I never saw any reason why operating such levers should prevent an engineer from seeing everything he should see for entirely safe operation. During my years of operating manual reverse levers I have observed various obstructions in the valve gear, such as link block pins working loose, fouling link saddle, and accumulation of sand or dirt in links. I detected them in this manner: I was accustomed to the usual resistance offered by the reverse lever when moving it from one position to another. With respect to the obstructions mentioned the resistance to movement of reverse lever in its travel through quadrant was normal until it had moved the valve gear to point where obstruction was encountered. At this instant normal resistance of reverse lever was noticeably increased and I was thus instantly warned that an obstruction to normal movement of valves or valve gear had occurred. I then immediately stopped movement of reverse lever and made an inspection to ascertain cause of obstruction. In cases of this kind if someone was working about the valve gear my immediate impression would be that I had caught some part of his body in the valve gear, and I would instantly move the lever in the opposite direction from that it was moving when the obstruction was encountered in order

1487 to free him. The obstruction I have mentioned I have had occur both running and standing (5311–5319).

I heard the testimony of Fireman Miles Crystal relative to Engineer D. W. Boggs being killed at Decatur, Ill., May 3, 1929, caused by Crystal operating the power reverse gear on engine 248. I recently checked the records of the Illinois Central back to and including the year 1930 and they show no cases where anyone was killed or injured by reason of the movement of the valve gear while working around engines equipped with manual reverse gear. Apart from these records I have no knowledge of any such occurrence on the Illinois Central. In my opinion and based upon my experience

and the facts testified to by Fireman Crystal, Engineer Boggs would not have been killed if engine no. 248 had been equipped with manual instead of power reverse gear. He probably would have escaped injury entirely. My basis for this opinion is that when a manual reverse gear is moved from any position the movement hestitates and is slow at its beginning on account of overcoming inertia of parts to be moved with muscular effort. This would have given Engineer Boggs sufficient warning to extricate his head from between the radius bar and main reservoir before it was clamped by radius bar. Whereas the power of the air pressure which actuates power reverse gear is so great the valve gear parts move with much greater force and at the beginning of movement with much greater speed than with manual reverse gear. Thus he received no advance warning. There is usually an audible exhaust from power reverse gear, but this exhaust takes place simultaneously with movement of reverse gear piston, hence it affords no advance warning. The opportunity for a man to extricate himself from a dangerous position is much better with the manual than with the power reverse gear. I base my opinion also upon the further fact that whereas our records I have previously referred to covering the past 10 years show
1488 eight cases of engineers being caught in valve gear on engines with power reverse gears, and injured, two of which resulted in death, there was not any such case on engines equipped with manual reverse gears. If Engineer Boggs had failed to extricate himself in time to avoid the radius bar catching his head, Crystal would undoubtedly have felt the obstruction with a manual reverse gear, and the manual power being much less than air power, Engineer Boggs would very likely have escaped with bruises instead of being killed. (Testimony by witness as to what would have happened to Engineer Boggs if engine had been equipped with manual reverse gear objected to by counsel for complainants but permitted to stand by examiner.)

Illinois Central locomotives are equipped with Ragonnet and Franklin precision types D and F power gears. I am familiar with their design and operation through supervising their maintenance as well as inspecting their performance and occasionally handling them when I ride our locomotives from time to time. The trouble I have experienced with Ragonnet gears is creeping and jerking, and jumping and jerking of precision gears. Creeping is caused by leaky piston rod packing and lost motion in connections. The term "creeping" is frequently confused with jerking or jumping of the gear. Whenever the pull of the valve gear becomes abnormal to the extent it is greater than the power of the gear to resist it, reverse gear piston will be pulled back and forth from one-quarter of an inch to one inch with each revolution of drivers. This causes an irregular exhaust, which frequently is reported by engineers as "creeping", whereas actual creeping of reverse gear allows reverse gear piston to move slowly in one direction, then slowly in the oppo-

site direction, and this movement is not synchronized with revolution of drivers.

1489 The precision power reverse gear is not suitable for all classes of service. Its operation is too slow for switching service or road service where considerable switching is performed enroute. We have received numerous complaints from engineers against it in this respect. The manual reverse lever provides the most accurate and reliable method known for adjusting valve travel. The power reverse is not accurate nor reliable when it creeps, jumps, or jerks. Creeping results in waste of fuel and if excessive, it interferes with obtaining maximum speed of which the locomotive is capable. On the Ragonnet creeping and jumping are caused by lost motion in the connections and leaky piston rod packing. Lost motion between the valve and the valve stem causes creeping on the precision. The jumping to which I referred is caused when the cylinder becomes dry over the greater portion of the inner service and a leak, either great or comparatively small, at one end or the other of the cylinder. The dry cylinder causes excessive friction of the packing up against the wall. As a consequence the piston does not move until the pressure on one side of the piston has reduced quite materially. And when it does reduce materially, then the piston jumps in that direction. Even with the engine standing still it will do that. Then when it jumps in that direction the valve moves to open the port which admits air to the piston side, and it jumps back in the other direction. I have seen them standing in the roundhouse, standing still jumping back and forth violently as much as an inch and a half and on every occasion when I have had an opportunity to investigate personally I found that it was this combination. This occurs not only in a roundhouse but anywhere the engine is standing still. It also occurs to some degree while the engine is running. It has a tendency to make operating wheel of the power reverse revolve in the cab. It does not always

1490 revolve. Frequently the latch which latches the wheel in a given position will hold it still. But if the latch is not in, or in fully, it may start the wheel revolving. It costs about six times as much to maintain power reverse gear as it does to maintain manual reverse gear. In my opinion safety would not be promoted by requiring the Illinois Central System to equip all of its locomotives with power reverse gear. So far as operation of the levers is concerned the manual and power reverse levers are both safe devices. Where men are injured while handling either, except in very unusual cases, it is the carelessness of the man that is unsafe and not the reverse lever. When considering the safety of others, such as those who are injured through becoming caught in valve gears when they are reversed, and accidents resulting from locomotives moving in a direction opposite to that indicated by position of power reverse lever, or when control of locomotives is lost on account of loss of air pressure, the manual reverse gear is much safer than power reverse

gear. Furthermore, accidents incident to operation of power reverse gear are generally of a far more serious nature than those incident to manual gear. So far as economy of operation is concerned, I do not know of any case where the power reverse gear is more economical or provides a better operation. So far as safety is concerned that is relative. There might be certain conditions under which the power reverse is safer than the hand reverse. A careless man could more easily get into the way of a manual reverse lever than he would in the way of a power reverse lever. I would not say that engineers as a general rule are careless and that that is the reason why they are hurt with manual reverse levers although in my many years of experience I have seen men do very careless things in the way of sticking their knees and legs up in the path of the reverse lever when there was no occasion for it. I never did it while I was operating a locomotive. I don't know whether you would be severe
1491 enough to call that careless, or perhaps they just did not think about it, although I presume we would call it careless. That is all I can think of right now as to whether the power reverse gear is safer than the hand. Taking it all in all, all kinds of accidents that occur, I consider the manual lever the safer. I would not say that the operation of these locomotives with power reverse gear causes unnecessary peril such as is prohibited under the Boiler Inspection Act. There are so many of them that you cannot equip with the hand reverse and while there are some that can be equipped with hand reverse just as well as power, I would not consider the locomotives which are equipped with power reverse as being equipped with a device that creates an unnecessary peril. From the standpoint of safety, as well as whether the Commission should require the exclusive use of power or hand reverse gears I rather think that both of these gears are too evenly balanced to prefer one over the other, for the reason that accidents occur with both kinds. I do not think there is enough difference from the standpoint of safety to make any difference between the two. I believe it would be very difficult to weigh up the safety of the two devices. They are both safe if properly handled. It is the human element that causes the accidents. My personal opinion is that neither should be considered a safety device. That should not be considered when it comes to equipping locomotives from a safety standpoint at all, because both are safe or unsafe according to the way they are handled (5319–5330).

From all I have learned and heard and read of the power reverse, if there is anything in favor of either one or the other so far as the maximum of safety is concerned, taking into consideration the accidents which do happen with the power reverse being substantially more serious than those which happen with the hand reverse, whereas probably the accidents that do happen with the hand
1492 reverse are more numerous but of a far more trivial nature, I would say that they were fairly well divided but if on account of the gravity of the accidents which occur with the power

reverse, if it were absolutely necessary that you have one or the other, either take them all off or put them all on, I would say if that had to be done it would be better to take the hand reverse lever. I have been of that opinion ever since the argument relative to safety first began. In fact, prior to a year or so ago, or until this agitation started for making it compulsory for power reverse gear on everything, personally I never had it brought to my attention or heard many arguments as to whether one or the other were safe. In fact we never thought about it as a safety device. I cannot say that I never thought about the unsafe features of the power reverse gear until this case started because every time you read a report about an accident with a power reverse gear or with a manual reverse gear naturally the safety feature comes to your mind. I don't remember when I first came to the conclusion that the power reverse was less safe than the hand reverse. I guess it was since this case started because prior thereto we had no occasion to try to analyze the safety of one as compared with the other. I am certain that when these 1,540 locomotives were equipped with power reverse the safety feature was not considered at all. While I did not establish the program I have heard the general superintendent of motive power discuss the matter plenty of times during conferences and I never heard him mention safety. He is deceased now. I think his reason for putting them on was because he thought the claims of the manufacturers were correct when they brought them out that they would facilitate the operation of locomotives. Particularly the switching locomotives, that they could be operated so much better and do more work and do it quicker. I know I had cases referred to me where we did not have a program for certain locomotives and
1493 engineers would write to him or see him on the road and ask him to put a power reverse gear on their engines. In some of those cases I did not think it was necessary, but the man was a good man, among our most valuable engineers, and a man who had done everything to help the service along; he wanted the power reverse gear, and it would make him feel a little better so I always recommended putting them on in those cases. In actual practice the use of power reverse gears has not resulted in any economy at all. The only resulting efficiency has been on those particular locomotives where the design was such that it was impracticable to continue the manual reverse lever. While practically every locomotive in service on the Illinois Central, 1,540, is equipped with power reverse I would assume off hand that not more than 200 are so designed that they could use a manual reverse lever without making it awkward and inconvenient. If they undertook to just take off those 200 there would probably be some complaints from some engineers, and others would prefer the hand lever. However, 200 out of 1,540 does not make very much difference so far as maintenance is concerned and just to keep on with a standard we will probably keep them like they are. In other words, it would be impractical to put the hand gear

on those 200 locomotives. The 172 locomotives that we did not propose to equip with power reverse gears are small local passenger, switch, and work-train locomotives, ranging from 61,200 pounds to 118,900 pounds on drivers, and 14,739 to 21,922 pounds tractive power. The reverse levers on these locomotives are easily handled and there is sufficient clearance between reverse lever and right side of cab to accommodate the engineer without the reverse lever coming in contact with him in its travel from full stroke forward to rear positions. According to our records the average cost for type A Ragonnet which we have applied exclusively to all locomotives on which manual gear was replaced with power gear
1494 is as follows: Material $334.90, labor $88.65, store and shop expense $76.45, total $500. The amount for store and shop expense was taken from the actual records of the accounting (department). I don't know the details but can furnish them later if desired. (Witness instructed to furnish said details.) The cost of applying power reverse gear to the 172 locomotives now equipped with manual reverse gear should be approximately the same. My estimate of the total cost would be $86,000 (5330–5337).

According to our records the average cost per locomotive per year for maintaining power reverse gears, including lubrication and inspection, is $35. Applying that to the 172 locomotives now equipped with manual gears the annual cost of maintenance would be $6,020. In addition there would be a cost of 4 percent for depreciation and 6 percent interest on investment, amounting to $8,600, or a total of $14,620 per year. The investment and yearly expense of the power reverse gears on the 1,540 locomotives now equipped may be stated as follows: At $500 each the investment is $770,000. Depreciation and interest per year $77,000; maintenance per year $53,100; or a total cost per year of $130,100.

With respect to the 172 locomotives not programmed for power reverse gear, it is the position of the Illinois Central, in view of their present large investment in these gears, that they should not be required to equip these remaining small locomotives with power reverse gear because they are not needed. I think, however, that the Commission should permit the 1,540 locomotives now equipped with power reverse gears to continue in service.

(At this point counsel sought to introduce an exhibit with respect to the financial status of the Illinois Central, for the years 1928, 1929, and 1930, and the first 4 months of 1931, prepared by the statistician upon request of witness. Witness admitted he had
1495 nothing to do with accounting. Upon objection by complainants the exhibit was not received in evidence. Further questions addressed to witness as to freight and passenger traffic on the Illinois Central at the present time as compared with the years 1929 and 1930 objected to by counsel for complainants on the ground that witness is not qualified to testify as to business conditions since the source of his knowledge is from various documents or reports pub-

lished by the railroad and from his general observations. Objection sustained.)

WITNESS (resuming, and answering questions by examiner). I do not recall off hand how many engines in serviceable condition we now have out of service or do I know how the number of engines in storage at present compares with previous years. I see all of the reports but do not fix these things in my mind. My information is gained from the same source as other operating officers obtain such information—the reports, and as I say in travelling over the line I naturally see the reduction in the amount of business. Of course, I am not an accountant and do not make up these figures myself.

(At this point counsel again seeks to have witness testify as to his general knowledge of business conditions on the Illinois Central at the present time as compared with previous years, on the ground that witness is actively engaged in railroad work. Objected to by counsel for complainants. Sustained.)

WITNESS (resuming). There are a great many more engines out of service now than there were a year ago. I don't know definitely the number but I know the difference is very substantial.

(Question as to whether there is more business being handled this year up to the present time than during 1930 for the same period objected to by counsel for complainants on the ground that witness is not qualified to answer. Objection sustained) (5337–5346).

1496 CROSS-EXAMINATION

The classes of engines which I had in mind when I stated their design made it impracticable to apply manual reverse were series 1031 to 1138 and 941 to 993. The numbers run serially, one for each engine. The 1031 to 1068 weigh 152,700 pounds on drivers; the 1069 to 1138 weigh 154,000 pounds. The company designed and bought these engines new. I do not think they could have been designed for manual reverse so that the lever would not extend back into the gangway. It is my understanding that if they had undertaken to make the cabs sufficiently long to avoid this projection back into the gangway the locomotives would have been too long for our facilities, such as engine pits, turntables, etc. The cab could not have been designed to accommodate the lever at the side because our side clearances would not have permitted that. On those engines I would estimate that the clearance is 14 inches on the side of the boiler from there to the side of the cab. If you put the lever along the boiler, as I previously explained, when the engineer would reverse the lever, it would come back and probably strike him in the breast. There is room on the side from the boiler out to the side of the cab for the lever itself, but you would have to set it way ahead of the engineer and when he would put it in back motion it would probably strike him in the breast. It is just in the backward and forward motion where I think the clearance would be restricted. There would not be any room for the engineer by the

side of the lever. He could not get in between the lever at the side of the cab. The cab could not be made wider because of our side clearances. I could not tell offhand how much clearance there is beyond the side of those cabs to the clearance limit, but I know it was always our practice to take all we could get. We wanted to get all the side clearance in the cab we could get. The only objection to equipping series 1031 to 1138 with manual levers is the
1497 forward and back clearance of the lever. The same reason applies to series 941 to 993. These are not the only classes of power which we have equipped with power reverse where we could not put on or have designed manual reverse. The others came with power reverse. These came with the manual and we replaced them with power reverse. They were originally operated with manual reverse but they were inconvenient. I could not say they were dangerous because I ran them about five years and never had any trouble. There was no danger of these levers coming close to a man's body because we set them over so that when reversed the lever projected back into the gangway. I do not see any reason why a man should be injured by a lever coming out beyond the backboard the way they did. I ran them five years and did not get injured. If the lever gave a jerk while handling it, it was possible to hit your elbow against the back of the cab. I had that happen several times and it did not jerk me against the back of the cab. I do not recall ever hearing of anyone breaking their wrist, elbow, or fingers, or any part of their arm by having it come in contact with the back of the cab until I heard of a lot of cases since this hearing started. There is not the same likelihood of a man catching his arm or wrist on the power reverse against the cab that there is on these engines where the Johnson bar extends back beyond the back of the cab. With the power reverse gear they are set far enough ahead so that they would not come back that far. There is more likelihood of a man getting in the way of the Johnson bar, which is a long lever with a long sweep, than there is with the power reverse operating lever. If he is careless enough to put himself in the way, he could do it more easily than with a power reverse gear. There are other engines where the cab is so designed as not to permit manual reverse. They are series 1139 to 1203, 1310 to 1312, 1501 to 1600, 1601 to 2017, 2400 to 2459, 2901 to 3025, 3500 to
1498 3569, 3793 to 3940, and 7000 to 7050. All the engines of the series I have named could be equipped with manual reverse if we wanted to incur the inconvenience of the lever extending back too far. That condition was sufficient for the Illinois Central to put on the power gear. It is possible to install and operate manual reverse on the series I have mentioned. I have never seen series 6000 to 6009, which are Mallet locomotives, equipped with a manual reverse. I doubt, however, whether there would be room to put a manual reverse lever in series 2400 to 2459 and 7000 to 7040. Those are large engines and the cabs are very congested (5346–5354).

Of my own personal knowledge I have never known of a case where a man was injured with the power reverse lever in the cab. I have seen reports of such an injury. We had a man named Chadwick who reversed the lever quickly and broke his ribs. I do not recall the exact date. It was about two or three years ago. I think the accident was reported to the Bureau of Locomotive Inspection. I recall two or three cases where a man incurred trivial injury, such as mashing his thumb between the latch and the lever, somewhat similar to the cases where they would unlatch the manual lever. I have seen some reports of cases where men have been injured on the manual reverse gear. I have heard of more cases where men were injured in the cab operating the manual reverse lever than when they were operating the power reverse. The case of Engineer Boggs, who was killed, is one of the accidents on which I base my opinion that accidents with power reverse are more severe than with manual reverse. It always takes a combination of circumstances, but such an accident would be attributable to the power reverse in this way. It is very unlikely that it would have happened with a manual reverse. That is my opinion based on about 30 years of working with them. My opinion is also based on cases where all the air pressure has been lost and the engineer has lost control of the engine, because he
1499 could not reverse and stop the locomotive; and cases where the air had been shut off for a long time and the hostlers, or others, would move the engine intending to stop it with the brakes and then find they had no air, and reverse the engine and run it into the turntable pit, and accidents of that kind. I remember about 29 years ago we had an engine equipped with manual reverse go into the turntable pit, but I do not recall any since. We have had locomotives equipped with power reverse run away when they did not have any air with which to reverse them. I never heard of a runaway engine equipped with a manual reverse on our road. Our engines which are equipped with Ragonnet power reverse gear are also equipped with an arrangement so that the engineer can turn in the steam to operate the reverse gear. Those equipped with Precision gear are not. You do not need it on the latter because you can exert more force by turning the screw and reversing them without the steam. It was a Ragonnet-equipped engine which ran away. It ran away with the hostler. He said he made an attempt to turn on the steam, but did not have time before he stood her on her head in the turntable pit. That is what I was referring to as a "run-away engine." I do not recall any run-aways on the road. If a man has a Franklin Precision gear he can reverse the engine by hand, by screwing it over if he loses the air. The hostler with the engine which went into the pit did not have any air at all. He got up and started the engine, taking it for granted that air was on it. When he got close to the turntable and started to apply the air he did not have any. He reversed his engine but, of course, that did no good and she went into the pit. The hostler was disciplined for this accident.

I have not read any literature published by the bureau of locomotive inspection with respect to power-reverse, but I have read a great deal about all the various power reverse gears; and those we do not have, I have examined at the conventions when they were
1500 on display. I attend the road foremens' conventions. I am not certain whether I attended the 1929 convention. There was one, either 1928 or 1929, when I only got there the last day. I did not hear any papers read on modern appliances on a locomotive by a committee appointed by the Road Foremens Association dealing with power-reverse. I must not have been present. I do not recall it. I have read so much about the gears that I might not recall just the very paper to which you refer. I have read lots of the annual reports of the chief inspector of the bureau of locomotive inspection.

(Questioned as to whether witness ever observed that chief inspector mentioned power-reverse as a safety device objected to by counsel for defendants. Sustained.)

WITNESS (continuing). Before this case started I do not recall ever hearing anybody claim that power-reverse was a safety device. When they first started out to apply it, my understanding was that it would facilitate the operation of a locomotive (5354–5362).

With respect to overcoming difficulties I have had in handling the manual lever, I previously testified that in the case of dry valves I increased the feed of the lubricator and, if necessary, eased off the throttle and reduced the speed and dropped the lever to the corner, and in just a few minutes the valves would be lubricated and you could proceed. It is so quick that it would be almost instantaneous, not over a minute, I would say, from the time you drop the lever down. As to whether I would handle the lever while the engine was dry would depend on what the lever tells me. The manual reverse lever tells an engineer what the conditions are; and if it showed considerable agitation I would not unlatch it, because I would have to let it drop to the corner. It would not carry me to the corner because I would let go of it and it would go to the corner itself. It is safe *a*nough to handle a lever under those conditions. I have handled the lever lots of times with dry valves. It was always
1501 safe for me—to do as I just explained. I have hooked engines up when the valves were not thoroughly lubricated and I did not see any danger in it, but, as I said before, I would lubricate them first. I would not see any reason to hook them up while they were dry. Whether or not it is a safe thing to do depends on the man. If he knows his business it is safe. If he does not, he is likely to get hurt. I have hooked them up when they were almost dry, when the lever jerked, but a man who knows how to handle the lever knows he does not have to pull the throttle wide open before hooking the engine up. No engineer who has a right to be called an engineer would undertake to hook a lever up running 50 miles an hour, with a wide-open throttle. There is no occasion to hook her up, because

if he is an engineer he has already got her there before getting up to 50 miles per hour. I would not do it; and I tell the engineers under my jurisdiction not to, to have their lever there long before reaching that speed. While I have often seen reverse levers drop to the corner at high speed and nothing happened, still it does not do the engine any good. There is no use on imposing on the engine to hook up the lever. Certainly he would not try to hold it at that speed with a wide-open throttle, because it would jerk and all he could do would be to let it fly into the corner. As I say, usually nothing would happen, but it would be a bad practice. It would be as foolish as for a man running an automobile forward to throw it into reverse motion. It would jerk him if he held to it and he would be foolish to hold to it. If the valves were dry, if the lever showed me from its vibration or rattling that the valves were dry—many times you begin to get the rattle before the valves get very dry, and they are just beginning to get dry—under those circumstances I have increased the feed and perhaps did not have to drop the lever in the corner. But if the vibration of the lever began to increase, I could tell from that whether it was likely to jerk
1502 considerably if I unlatched it. In such case I would ease off the throttle and reduce speed if necessary until the rattling eased up and then take the lever and let it down in the corner without any trouble. In other words, you sometimes have to reduce the speed of the train before it is feasible to handle the lever. I have had that happen, I guess, four or five times in 20 years. The primary cause of the decreased efficiency of an engine is the valves getting dry. The engine is not going to make the speed it should, regardless of whether you keep it hooked up and wide open. It is going to slow down if it gets dry. The quickest and best way to overcome the condition is to do what I have said (5362–5366).

REDIRECT EXAMINATION

The 20 years I just referred to cover the time that I was locomotive engineer and traveling engineer. It would really be 18 years instead of 20. The number of times that I have experienced dry valves is about the same as that of others who have come under my observation in operating engines on the Illinois Central. On the various engines which I have ridden over various parts of the system they practically never have found any dry valves. In fact I do not recall now when I have seen any dry valves. With reference to side clearance the width of the locomotive cab is just about the same as the width of the tenders and cars on our railroad. By side clearances in connection with the question "Why could not the cab have been made wider", I referred to the clearance limits that the Roadway Department sets up to clear bridges, supports, tunnels, and things of that kind. We could not increase the width of these locomotive cabs without making them wider than the remainder of the rolling

stock and the rolling stock is built to the clearance widths made standard on our railroad.

(Witness excused.)

(At this point counsel for defendants entered an exception to the ruling previously made with respect to the last questions asked witness during his direct testimony as to his knowledge of
1503 business conditions on the Illinois Central at the present time as compared with 1929 and 1930. Exception granted.) (5366–5368.)

1504 J. E. BJORKHOLM, assistant superintendent of motive power, Chicago, Milwaukee, St. Paul & Pacific Railroad, testified:

I am familiar with the locomotive and its different parts and also with locomotives equipped with manual, as well as power reverse gear. The Milwaukee Railroad owns 1,713 steam locomotives. Right now approximately 500 of those are not in active service. That is an abnormal condition, of course, on account of the present business depression. About 300 of these locomotives are serviceable. We have quite a large number of serviceable engines that are only used during the peak seasons, passenger engines, for instance, that are used only during the football season of the year, and during Christmas travel; and also freight engines which are used only during the peak season when we have a heavy grain movement in the northwest. The Milwaukee road has 498 locomotives which are equipped with power reverse gears. They are equipped with different makes of power reverse gear, such as Ragonnet, Lewis, Alco, Barco, the All-Service gear, and a small number of the old Melline gear. The latter, however, are not on engines now in active service. 363 of these gears were applied on locomotives purchased new. 48 were applied under an act of the Wisconsin Legislature. Some 30 gears, in round numbers, were acquired on locomotives when we leased the Chicago, Terre Haute & Southeastern and the remainder we have put on old locomotives. As I stated, the major portion of these were applied to new locomotives or due to legislative action. The others were applied as a result of a request made by the representatives of the Brotherhood of Locomotive Engineers in 1928. They made a request on the management that certain engines, Mikado engines, that were then being retired from road to switch service be equipped with power reverse gear, stating as the reason
1505 for the request that on account of no pension system prevailing on the Milwaukee road we had a lot of rather old engineers in yard service, and, of course, as those engines carried the highest rate, the old engineman, under the schedule provisions, was permitted to exercise his seniority, that is, to obtain the highest rate of pay. For that reason, they requested the management to place power gears on those Mikado engines, and the management promised that when finances would be so that they could do it they would give the matter consideration and the following year some 40 to 42 engines were equipped.

The real factor which determines the necessity of a power reverse gear on the locomotive is the design of the locomotive, as to whether or not clearance or lack of clearance permits the mounting of a manual lever in such a manner that it can be properly operated. The types of locomotives which we have equipped with power reverse gears are the 4–6–4 and 4–8–4 passenger engines, a large number of Mikados, in freight and yard service, and those which we acquired from the Chicago, Terre Haute & Southeastern. In all classes of service these power reverse gears have not been entirely satisfactory. In slow freight and yard service the gear has functioned satisfactorily, but in fast freight and in high speed passenger service the functioning of the gear has been very unsatisfactory. I have experienced actual engine failures or delay to trains on account of the power reverse gear not working properly, due to creeping or break-downs. For example, in 1929, in the passenger service between Chicago and the Twin Cities all engines were equipped with manual reverse levers. During that period we had three engine failures due to trouble with reverse levers resulting in total delayed time of 29 minutes, or approximately 9.5 minutes per failure. During 1930, with the new 4–6–4 engines placed in service and equipped
1506 with power reverse gears we had 13 failures due to trouble with the reverse gears, resulting in a total delayed time of 4 hours and 26 minutes, or approximately 20½ minutes per failure. So far this year we have had 22 failures resulting in a total delayed time of 7 hours and 11 minutes or approximately 21 minutes per failure. In 1930 and 1931 we operated two trains less in each direction than in 1929. The passenger engines used in 1930 and 1931 all came equipped with the Alco type G power reverse gear; 14 engines altogether. Later, in account of the serious trouble we had with these gears creeping, we equipped for trial two engines with Barco gear and one engine with so-called all-service gear. The G type Alco gear is the latest model. The Barco B–4 is also the latest model.

In slow service the power reverse gears do not require much maintenance work, but in high speed passenger and freight service, particularly so in passenger service, on account of the very high piston speed of the engines, it requires constant attention to keep the gears in fairly serviceable condition. I say "fairly serviceable condition" because the gears have not at any time functioned satisfactorily. The perplexing thing about the gears as we have found them is that although they are maintained in their sound physical condition, particularly when on account of the necessity of making up time of delayed trains, a locomotive has to be run at a very high rate of speed, the gears give constant trouble from creeping. The reason for that, of course, is that in slow service there is considerably less strain placed on the gear than when in high speed service. These high speed passenger engines are the 4–6–4 and 4–8–4. There is only one of the latter. These engines could not be equipped with hand gear because the outside dimension of the fire box is

1507 something like 9 feet 8 inches while the inside dimension of the cab—and the cab is as wide as the clearance line of the locomotive permits—is 10 feet 4½ inches. So that there is a lack of clearance to mount the hand operated lever (5369–5376).

With respect to our efforts to overcome the failure of the power reverse gears to function properly, starting with the Lewis gear, which came with the administration Mikado engines, we tried two different types of rotary-controlled valves in 1929 and 1930, in an attempt to make those gears more reliable. I might say that the reason why these gears started to give us more trouble in later years than they did formerly was because freight-train speed was increased considerably in later years, and with the higher speed these gears commenced to give us considerable trouble. We have found, however, after trying a large number of these new type rotary-controlled valves that they did not solve the problem and now we are experimenting with another control for these gears. On the 4–6–4 engines they gave us considerable trouble from the very beginning and the factory representatives as well as our own were at their wits' end trying to get the gears to function properly. We tried on one engine, at the suggestion of the manufacturers, to equip the valve motion with what they termed a shock obsorber, which was nothing but a resistance disk placed at the coupling of the tumbling shaft and the radius rod. This was for the purpose of trying to keep the valve motion members from imparting too much strain to the power reverse gear. This appliance did not prove satisfactory. So now, in the last few months, we have equipped these gears with an altogether new type of operating control valve. This has improved the gears but we have found that weaknesses which were not apparent in the gear before that are now becoming so. The cost
1508 of applying this new control valve amounted to something like $90 per locomotive. The average cost of applying the 42 gears previously mentioned in 1929 was $423 per locomotive for the Alco gear which has the lowest market price. If any other gears had been applied the cost would have been from $50 to $100 greater per locomotive. Based on the cost of $423, if we were to equip all of our steam locomotives not already equipped, it would mean a capital expenditure of $515,525. The running maintenance cost of the gear, outside of back-shop overhauling, amounts to something like $15 per year for all types of locomotives. In addition to this $15 the shop overhauling of the gear when the engine receives classified repairs so far has averaged $28.10 per gear. This would mean that if all steam locomotives of the Milwaukee road were equipped with power reverse gear the added annual maintenance cost would be $35,325. In round figures, maintenance of the manual gear will run somewhere around $7 or $8 per year, including the cost of back-shop overhauling with annual roundhouse attention. On engines in high-speed service the manual reverse requires a good deal less attention than the power reverse gear. In slow freight and yard service

the power reverse gear does not require very much attention. I think it would be about a fifty-fifty proposition in slow service. The failures of the power reverse gears which I previously mentioned were recorded over a period of two years. In May and June of last year on account of the very frequent complaints the manufacturers had two representatives, one at Chicago and one at Minneapolis, for practically two months making inspections and offering suggestions as to what to do to overcome the difficulties with the gear. The result was that they were not able to do much, so we removed the gears from three engines and applied other types because
1509 the representatives of the latter claimed they would not creep, but we were sadly disappointed.

(At this point question presented to witness as to whether, in his opinion, the installation of power reverse gear on all engines would be of sufficient benefit from either an operating or safety standpoint to warrant the expenditures previously mentioned objected to by counsel for complainants on the ground that it calls for a conclusion by the witness on a matter for the Commission to decide. Objection sustained.)

(Objection to question as to whether the safety of operation would be prompted in any way by the application of power reverse gears overruled.)

WITNESS (continuing). I would say from the experience we have had with either gear that there is nothing to warrant the application of power reverse gears to all locomotives on our road (motion to strike this statement as not being responsive, denied) (5376–5381).

With respect to the matter of handling the manual reverse lever my experience has been that while there may be circumstances which may cause some individual lever to move hard, as a general rule I have not found any difficulties in handling the lever. The principal things which cause a manual lever to work hard are the mounting of the gear in a careless manner, having the various connections out of alignment, rocker boxes, etc., tightened up too snugly, lack of lubrication in the various bearings, and lack of lubrication in the main valves of the locomotive.

"Examiner ROGERS. Mr. Bjorkholm, I was just thinking about your previous answer. I would like to have somebody check me up on this, but it runs in my mind that of all the accidents that have been investigated by the Bureau of Locomotive Inspection since its establishment, there have been more accidents and injuries due to reversing gears than any other part or appurtenance of the locomotive. Have you ever run that down, Mr. Bjorkholm, to see what the facts are?

"The WITNESS. Mr. Examiner, talking from published figures, annual reports, for instance, that you no doubt have in mind, I have the same picture in my mind.

"Examiner ROGERS. You mean the annuals reports of the chief inspector?

"The WITNESS. Yes, sir.

"Examiner ROGERS. That is what I am talking about (R. 5381 and 5382)."

1509-a But that does not necessarily indicate that all of the accidents were caused by the reverse lever handling hard. It is an old saying that "familiarity breeds contempt." Often-
1510 times an engineer, by reason of having handled the reverse lever with ease without any harm whatever, becomes careless and sometimes when he could put his foot perhaps just as well on the brake valve when attempting to handle a lever that may be as easy to handle as it should be, places his foot in such a position that if he is foolish enough to handle the lever at a time when he should not, the lever will go in the forward corner and the result is that he occasionally has a smashed foot. Another type of accident that is oftentimes laid to the hand reverse is where a man is reported as having ruptured himself. Whether such an accident was caused by undue strain at that particular moment, or something that just happened to break at that particular moment, instead of from weakness in his body as I understand it, is something which is debatable among medical authorities. I have recently observed an engineman handling the manually operated lever while running at a high rate of speed, and there did not appear to be any trouble in handling the lever. In order to have some specific and accurate figures as to how often it is usually necessary for an engineman to change the position of the reverse lever on a through train I made some trips on our very fastest passenger trains between Chicago and Milwaukee. I found that after leaving the Milwaukee station the first time the engineer would hook up the reverse lever would be when he was about one-half mile away from the station, the reason for that being the speed restriction rules in that territory, so that he had no occasion to attempt to regain any speed before that. The first time he hooked up the lever he did it with one hand, that was at a speed of from 12 to 15 miles per hour. The second time these engineers would hook up the engine was at a speed of from 20 to 25 miles per hour, then again at 35 and 40 miles per hour.
1511 After that the reverse lever was in the conventional running notch. In the last three cases the engineer would use both hands in hooking up the lever. Then the lever was not disturbed until the station at Sturtevant was reached, which is a regular stopping point. Approaching this point, after the engineer had applied the brakes and brought the speed of the train down to about 35 miles per hour, he shoved the reverse lever down into the forward corner with one hand, leaving Sturtevant the performance was the same as at Milwaukee and the lever then was left in that position until they approached Chicago for slow downs, when the lever was let down to about half stroke. This was in the highest speed service we have, one hour, 45 minutes between Chicago and Milwaukee. All the locomotives in that service are not equipped with power reverse.

These are on the short runs between Chicago and Milwaukee where we have 4–6–2 engines. In through service and between Chicago and the Twin Cities the 4–6–4 engines are used. The weight on the drivers of the locomotives I have just been describing as equipped with hand reverse gear is 157,000 pounds.

If any part of a locomotive fails to function properly while in service it is brought to my attention in this manner: The engineer of a passenger train is required to file a report at the end of his run when a delay in excess of two minutes occurs whether those two minutes have been made up subsequent to the delay or not. A copy of that report goes to the chief trainmaster and another copy to the master mechanic. After the latter has investigated the various details of the delay, a complete report is forwarded to me and I, in turn, forward it to my superior. The engineer is required to report any delay and is also required to file what is known as a work
1512 report at the end of each run. I have made a check of these reports for the purpose of ascertaining to what extent, if any, the power reverse gear has been reported as unsatisfactory.

(Question as to what such a check revealed objected to by counsel for complainants on the ground that the reports from which witness checked were hearsay. Witness permitted to explain what he did.)

WITNESS (continuing). I personally checked all the work reports filed by enginemen on the 4–6–4 engines at Chicago and Milwaukee for the months of May and June 1930 and July and August 1931 and noted all items reported by the enginemen having any reference whatever to the power reverse gear whether it was a case of ordinary maintenance items or some extraordinary defects and I have tabulated those excerpts.

(At this point counsel for defendants present as an exhibit the tabulation prepared from the work reports above mentioned. Tabulation received in evidence and marked "Exhibit No. 66", with the understanding that counsel for complainants will be given access to the original reports for purpose of cross-examination. Counsel for complainants noting exception to the admission of this exhibit.)

WITNESS (continuing). The engines covered by these reports are the 4–6–4 engines in the passenger service between the Twin Cities and Chicago. That is the class of locomotive on which I said the hand gear could not be applied (5381–5389).

CROSS-EXAMINATION

The 500, approximately, power-reversed engines which we have are engaged in the fastest and the heaviest service. In passenger main-line service I would say that approximately 35 percent of the trains are handled by engines equipped with power reverse.
1513 By that I do not want it understood to mean 35 percent of the number of trains, but about 35 percent of the mileage covered by those trains. Our fastest freight service is handled by engines

equipped with power reverse gear, with the exception of some five or six fast freight trains on one division not served by that type of engine. Even the slow freight service is served now by engines equipped with power reverse. We did not equip the Mikado engines previously mentioned with power reverse because they were too heavy to handle with manual reverse, but because these engines were placed in service where reversing of the engine was to be quite frequent; and in order to comply with the request of representatives of the older engineers, we felt that it would make the work more pleasant for them by equipping these engines with the power gear. The request for the change was made on the basis of handling the gear.

I was not requested to give my opinion as to the type of reversing gear to be designed into the approximately 363 new locomotives that were purchased, nor have I been requested to give such advice with respect to the reversing gear or any new engines since I have been in my present position for the reason that we have not built any new engines in recent years, except passenger engines which were designed in 1929, and up to that time on account of the comparatively slow service the gears had not given any particular trouble, but as previously mentioned, in the last two or three years speed has been increased tremendously in freight service and in that time we learned a lot about the unsatisfactory condition of the gears which were not revealed in the slower service. We are now building some passenger engines and I was called upon by the chief of the department to give my recommendations as to power reverse gears.

1514 I very strenuously opposed the type of gear that we had on the original 4–6–4 engines. However, that resulted in a compromise and we are now equipping these engines with the Alco gear but the Alco gear that we now have on the original 4–6–4 engines, which is what you might say two different types of gears built into one, or in other words, we have taken certain parts of the all-service gear and attached those parts to the Alco gear, because that has proved to us to be the most satisfactory solution of the trouble so far. The all-service control valve is composed of four poppet valves instead of the slide valves originally applied to the Alco gear. With respect to these new locomotives I recommended the Alco gear with this modification. We could not mount manual levers on these engines on account of the lack of clearance nor could we provide clearance, so as to accommodate a manual lever and still have the size of engine we wanted. The clearance between the boiler head and the inside wall of the cab is so restricted that we had a lot of difficulty to mount the few things which had to come in there and it would be utterly impossible to mount a manual lever or a heavy reach-rod going through there. I presume the lever could be mounted behind the boiler head but it would be a very inconvenient place. It would be possible to put it on the left side of the engine but it would not be practical because the engineer could not reverse the engine from his usual position in the cab.

The definition of an engine failure on our railroad is a delay to a passenger train of two minutes or more, caused by any defect on the locomotive, even though the two minutes may be made up. I cannot tell, because I do not have the figures with me, whether the engine failures in 1929 and 1930 which I previously mentioned were
1515 the total of engine failures within that definition for those years. I will say, though, that those engines have been very successful and we have had very few delays. In 1929 there were three failures reported on engines equipped with manual levers, one with a delay of five minutes, one with 11 minutes and one with 13 minutes. In two cases the engineer reported that a lot of ice and snow worked into the rewerse-lever shields and in the other he was unable to run the engine at the proper cut-off on account of cut valve bushings.

(At this point in response to inquiry for a summary of the delays with power reversed engines in 1930 and 1931 up to time of hearing witness presents statement covering the details and causes of such delays which was received in evidence and marked "Exhibit No. 67.")

WITNESS (continuing). These were all on one class of engine but are not representative of all power reverse gear engines in slower service, in freight service. They are particularly aggravating in high-speed passenger service. No one was injured in connection with any of these delays (5389–5396).

One of the service men of the manufacturers who worked with me during the two months previously mentioned was named A. Brown. I cannot remember the name of the other fellow. They both worked out of the Chicago office of the American Locomotive Company. They were service men exclusively and never sought to sell any of their company's devices. I never made any formal complaints to the manufacturers about these gears. I report to my chief and I know he has written some very serious complaints to the Alco people about these gears. The Alco men did suggest almost any conceivable thing that they felt could be done to improve the gears, and we were perfectly willing to listen because we had previously done all we know how and had failed. But at the end of their visit we found that very little had been
1516 accomplished. They suggested, for instance, that we change the lubrication from oil to grease and from grease to oil again; that we examine the packing cups on the piston and we were willing to do that; that we increase the lead on the small slide valve in the operating control valve off the power gear, and we did that. Another suggestion was to put a shock absorber or resistance disk on it to see if that would help but it did not prove satisfactory. So when they left we were just about as bad off as when they came. Most of the failures shown were due to breaks, only five due to creeping. Creeping does not necessarily become an engine failure to the extent that it is reported by the engineer for that purpose. With respect to

broken parts we will take the first one here: "Lug broken off air-reverse casting." That is something we have tried to correct and the manufacturers have tried to correct it but it is not corrected yet. It is one of the reasons why we have gone to an altogether different type of control valve, foreign to this gear entirely. When that lug breaks, it takes away the control entirely from between the reach rod and the operating valve, and the valve goes in extreme forward motion and stays there. The lug is for the purpose so that when the operating lever is put in either extreme forward or backward position, to stop the over travel of the small slide valve, if that lug breaks, then it takes away the control entirely between the operating lever and the operating slide valve. These trains are practically all night trains. There is no telegraph operator for long distances during the night and an engineman may have from four to six minutes delay after he has left one telegraph station but he may be able to pick up that delay before he comes to the next open telegraph station and he does not like to write letters any more than
1517 I do so that he keeps quiet about it. That is why it does not appear. I know that to be a fact because I have been an engineer and it occurred a number of times.

I imagine the first power reverse gears we had were on the Mallet engines back in 1910 or 1911, the old Melline gear. I was in active service at that time as an engineer. I have operated the power reverse and have had a rather sad experience with it. The power reverse has the advantage of being a device that can be so mounted that it can be used for the purpose of reversing and controlling the valve motion on locomotives where a manual lever cannot be mounted and properly operated. We have locomotives equipped with power reverse of such design that they could be operated with a manual lever. They are the engines which were equipped with power reverse gear as a result of the engineers' request in 1928. They operate all right with power reverse. The present design of locomotives with the wide fire boxes has made the power reverse necessary and imperative. The inefficient operation of the power reverse results in inefficient operation of the locomotive. Creeping affects the fuel consumption materially, but to what extent would be impossible to arrive at in figures. In the slow service the gear holds satisfactorily and in that service it does not affect the fuel consumption at all. In real high speed service where the gear is creeping if the engineer cannot keep his valves at an economical cut-off but finds the valves moving back and forth violently, naturally it is going to adversely affect fuel consumption, but to what extent I do not suppose anyone can say accurately. We did not have this fast service until we had locomotives equipped with the power reverse.

We did not have to have the wide fire box in order to get fast
1518 service and power out of the locomotive because we have just as fast service on smaller trains as we have with these modern wide fire boxes. We have these trains between Chicago and

Milwaukee and Chicago and Omaha. They are lighter trains. We did not have this fast service on the same weight of trains before we had these wide fire box engines. In other words, we have just as fast service but with lighter trains in other districts as the service between Chicago and the Twin Cities where those wide fire box engines are used and where the trains are much heavier. In order to have heavy trains in fast service we had to have the wide fire boxes. I cannot state whether there is any economical advantage in having the heavy fast service. The traffic and operating departments put the schedules up and we furnish the engines to meet the schedules. I am not acquainted with the reasons back of those schedules. In the case of one engine hauling 55 freight cars and another hauling 75 cars over the same distance in the same length of time, in my opinion the heavier engine hauling the larger number of cars would be a more economical operation. Likewise with respect to the fast service between Chicago and the Twin Cities the heavy engines with the wide fire boxes result in more economical operation than with a greater number of lighter trains. The reverse gear has become a necessary evil on the large fire box engines, but so far the advantage of the wide fire box more than offsets any disadvantage there might be in the power reverse.

If we felt that there was any particular danger in connection with the power reverse gear from a point of safety to life and limb of the men operating the engines we would hesitate very much before we made any applications, if there were any avenue out of it. I do not recall any injuries except some minor ones to enginemen
1519 on power reverse gear engines and we have been quite fortunate in later years by means of a better degree of maintenance and the efforts of the "safety-first" department to eliminate injuries on the hand reverse gear engines. As to the question of whether the power reverse gear might be in any degree safer than the hand gear I do not think that we would equip our engines with anything we thought or knew was going to produce any particular hazard simply to get this increased efficiency which results from the wide fire box and these close clearances or widths. My experience has been that when it comes to the safety of life and limb of the enginemen neither the power reverse gear nor the hand lever could be seriously considered to the exclusion of the other.

The type of failures shown in exhibit no. 67 were caused by high speed and might be reduced in proportion with a reduction in speed. We appreciate that the function of the reverse gear whether manual or power is to reverse the valve mechanism on the locomotive, and also to enable the engineer to control the valve travel and keep the valve motion in a certain position. The valves on these engines weigh somewhere around 300 pounds, they move reciprocally, at a very rapid speed, and as the speed increases and the number of times that the valves must be reversed increases it increases the strain imparted from the valve motion to the reverse gear. That

strain is in proportion to the piston speed and not to miles per hour on a low-wheeled engine and one which does not make the same miles per hour we might have the same piston speed we have on these engines. With respect to my testimony concerning engineers sustaining rupture by the operation of a manual reverse lever it might be assumed that they could receive similar injuries when handling some throttles which are just as hard to handle as the reverse lever but I do not know of any such injuries.

1520 There is a possibility of danger in handling the manual reverse lever and the wise engineer is at all times careful. He would stay out of the line of movement of the lever when through its actions it indicated to him that the valves were becoming dry, or something of that kind, because in those instances the lever jumps out of the regular notch and moves forward one notch. If he is in the way he might be struck and seriously injured. But an experienced engineer should know that this sort of thing does not happen without warning. That is my opinion from experience. Of course, there may be occasions when the reverse lever may act without any warning. I presume if the ring broke in the valve and got lodged in the valve port and caught by the valve the warning would not be very substantial. The wise thing for the engineer to do at all times is to keep out of the track of motion of the manual reverse lever when the engine is in motion. The power reverse lever will act similar to the hand lever and go from the extreme forward corner of the quadrant to the extreme back corner. The only reason we can imagine which causes this is that for some reason or other there is a great strain transmitted from the valve motion to the power reverse gear. There may be perhaps some small defect suddenly occurring in either the main valves or in the power reverse gear cylinder. The Lewis and the Alco power reverse gears are the only ones that I have had personal experience with where the lever moved back and forth in the quadrant. It will do that on the present type G Alco. There is no direct connection between the valve motion parts and the small operating lever of the power reverse in the cab. I have seen the power reverse lever thrash back and forth with force but it would

1521 not be entirely comparable with the manual reverse lever because the lever of the power reverse is shorter and its sweep not as great as with a hand lever and it is more our of the engineer's way than the hand gear (5396–5412).

(Witness excused.)

1522 JOHN J. HUGHES, 42 years old, employed as assistant foreman, dispatching engines, for the Central Railroad of New Jersey, testified:

In 1927 I was employed as air-brake machinist. My duties were taking care of all air-brake parts and of the air reverse. On October 20, 1927, I was injured while working on engine no. 904 at

the Communipaw engine terminal. That engine was equipped with the Alco power reverse gear. I was renewing the packing leathers in the power reverse and had removed the reverse lever and put air in the front end to move it to the back end. Then when I got back there I shut the air off in the cab—or my helper did. That is the main air valve to the power reverse. I then opened the drain cock in the front of the cylinder to let whatever air that was in the front of the cylinder escape. The air came out and then the oil started to run. I left the cock open. I first tried the reverse lever to see that there was no more air there and then I started to remove the back head. After removing the back head I then started to take the nuts off the reverse gear forward head which comes off. There were eight one-half-inch nuts on the forward studs. When I came to the last one I had two ⅜-inch bolts to get the forward head out, because those forward heads are stuck there and you can follow on in and take the head off by hand. I went for the two ⅜-inch bolts, and when I came back I removed the last one-half-inch nut off the forward head and when I did she let go. The piston head and everything came out and drove my hand against the cylinder cock rigging. I had the first finger of my left hand partly cut off, and the others lacerated, and one bone broke in the wrist. I was off duty eight weeks and received $150 from the company. They also paid for two X-rays and the doctors bills.

1523 As to what caused this mechanism to come out, the only thing I can see is that the pressure built up from the time I left until I came back one-half hour later. The valve must have leaked and the pressure built up in that cylinder. Why it did not come out from the quarter-inch cock was probably because it was stopped up from some settlings and the pressure was built up in that way. I do not know whether the valve was leaking or not, because I went to the hospital right after I was knocked off and I did not go back to the railroad until it was time to go to work.

(Motion by complainants' counsel to strike the foregoing narration from the record as having no relation to the hazards of a power reverse gear in the operation of an engine—denied.)

WITNESS (continuing). With respect to my statement that "everything let go" I mean the two packing cups and both forward heads came right off the piston. They did not come slowly, there was just one blast. My hand happened to be right there and it was driven against the cylinder cock rigging which lays up against the power reverse.

Once or twice while working around a roundhouse I have observed the valve motion move without anyone operating the lever in the cab. I have worked around a roundhouse since 1913, up to last year. I am still just the same as around the roundhouse because I am on a locomotive most of the time.

I had the pet cock open all the time and air came out first, and, as I stated, I tried the air reverse back and forth and if there was any air in there the reverse lever did not move. Then I left the cock open so that if any air should build up there it would come out. Some settlings must have got in the cock and the pressure built up in there while I was going for the ⅜-inch bolts (5414–5419).

1524 CROSS-EXAMINATION

I was taking the forward head off to renew the packing leather which was blowed badly. In unscrewing the forward nuts I did not feel the air escape. When the air seemed to be gone the oil came. When the air is gone the oil which is left there comes out. After the accident I did not make any investigation to see whether the main air valve was leaking or not; I went to the hospital. I have been working around the roundhouse since 1913 and only saw the valve motion move by itself on two occasions.

I am still acquainted with locomotive no. 904. It is there yet. It was always equipped with power-reverse. It was purchased new; I cannot recall the year.

Part of my finger was cut off. You can see the spot on it here [indicating]. The finger is there but it is no good.

REDIRECT EXAMINATION

I do not have full use of the finger. This is as far as it will go [indicating] (5419–5422).

E. C. GLOVER, 38 years old, employed by the Atlantic Coast Line Railroad, testified.

I got my first railroad experience in June 1914, when I was employed as a fireman by the Southern Railway. I went with the Atlantic Coast Line in May 1918 as a fireman. I was promoted in October 1918. I have had experience with both hand and power reverse gear, about fifty-fifty. On September 7, 1928, there was an accident on engine no. 1553. This engine was equipped with a Ragonnet power reverse gear. I cannot recall the model. I
1525 was the fireman. In starting on the trip the engineer asked me to stop the engine for him to oil. After I did this, I moved the reverse lever from the corner to the center. I noticed the reverse lever moving very fast and the valve gear. I moved the reverse lever in forward motion. Of course, it stopped. The next I noticed was at the time the accident happened, between Dunn and Godwin. We were running around 55 or 60 miles an hour, and she reversed herself. She cut steam off and closed the ports. I thought the rods were broke or she was on the ground. Fire was flying under the body of the engine. Of course, he put the brakes in emergency position. I got down on the ground myself and could not see any-

thing wrong. Of course, we proceeded to the next station, which was Dunn, and stopped. I took the shaker bar in the cab and tightened up on the packing but to the power reverse piston. That tightening of the nut did not remedy the situation. Again between Micro and Kenly, N.C., she did the same thing or started to do the same thing, and he caught it before she reversed herself and pushed the bar, the reverse lever, out of the center of the quadrant. The lever was about in the center of the quadrant. It is the practice to work them there, especially at that speed. It was bound to have been maybe one notch in head gear. I could not tell whether it was on first notch. You generally go by the valves, listen to the valves. Of course, you cannot pull it clean back, because you would cut the steam off from the valve. I did not pay any attention to it because I was firing. The working notch is according to the speed of the engine. When you start a train, especially a heavy train, you cannot pull the bar, but must pull it up as the speed increases, because it will close the cut-off. You would never make any speed with the bar in the corner. The same way with an automobile, you have three gears, and you have to have the gear changed as the speed in-
1526 creases. At the time this accident happened it should have been about one notch from the center of the quadrant.

After leaving Kenly the reverse gear did the same thing once more. That was between Wilson and Elm City, N.C. The engineer did the same thing as before, pushed the reverse lever out about the center of the quadrant. After he moved the lever out of the quadrant he did not have a short cut-off. There was a verbal report made by some member of the train crew to the engineer that the wheels were flattened under the train. It was made in my presence, but I do not remember where it was made or who made it. (Testimony as to verbal report objected to as hearsay—sustained.)

Prior to this time this engine did not function properly. The valve creeped. At the beginning of my testimony I stated that the power reverse gear piston moved back and forth very fast. To describe that a little more in detail, I raised the reverse gear out of the corner into the center, while the engine was standing, and after I did that the valve gear began to shake and air escaped from the power reverse cylinder. The lever in the cab did not move. It was fastened in the corner, but you could see it jerk. The engineer evidently saw the valve gear move; he was oiling around. I did not tell him about it. It is unusual for an engine of this class to do this unless there is something wrong with the power reverse. By unusual I mean that you won't catch one; maybe this is the second or third one I have seen do that, and the worse one. The engine was standing at the time in the terminal. I did not tell the engineer. That was up to him. He was nearer the performance of the valve gear than I was. He was on the ground. I do not know whether he saw it, but he should have. The engine was taken on out of the terminal without anything being said to the engineer or the shop forces about it (5422–5430).

1527 CROSS-EXAMINATION

I had been running as an engineer about ten years when this occurrence to the power reverse took place. In my opinion the power reverse was in bad order on leaving the terminal, but I did not report it. As previously stated, I saw fire flying from underneath the engine when this happening took place. The cause of this was that after the engine reversed itself the train pushing the engine, or the engine being in back motion maybe, and the engine pushing it maybe, caused the fire to fly from the wheels to the rear, and maybe sliding or lurching back and forth or lunging. I do not recall that this class of engine on the Atlantic Coast Line gave lots of trouble about jumping the track, with the middle driver getting off the track, on several occasions. I do not remember of some class of engine on that railroad getting off the track and jumping back on. I have heard only one engineer say that.

On this occasion I did not make an investigation to see whether the driving wheel was off the track. I got down and examined the engine in the position it was standing. I did not go back to see if there were any marks on the rails.

1528 Mr. Sydenstricker was the engineer on that occasion. Previously he was fuel inspector. I think he worked his engine about as close as the average man; maybe a little closer. He had a general reputation for working his engine very close to the center, and it was very close on this occasion. I have fired this engine since this happening but have had no further trouble. I have never had any trouble to amount to anything with any other air reversed engine. I have seen them creep very little. I have had experience with manual reverse but was never injured by one. I have had them jump out of the quadrant a good many times. When that happened, they always latched in the corner of the quadrant, all the way to the corner most of the time. It went with severe force if the throttle was wide open. It would hardly ever jump out of center without the throttle open. Running at high speed, I have had difficulty in adjusting the manual bar to regulate the cutoff if it was sticking a good bit and if the engine was not properly lubricated. If the engine was in good shape, the reverse lever could be handled pretty good on the smaller engines. What I mean is if you had the throttle wide open, you could not take one hand and pick her up, but would take both hands and your feet. I do not think it could be done on the big engines (5430–5434).

REDIRECT EXAMINATION

During my experience as an engineer, I have had the lever jump out of the quadrant 25 times, I suppose. Sometimes you will get an engine on a 150 or 175-mile run, and if you do not hold the latch, maybe it will fall out eight or ten times, if you do not hold it down close. Sometimes when you hold the latch you put your hand

1529 on the fulcrum. There is bound to be a defect on such an engine, such as the quadrant being out of line one end or the other. The quadrant could have been worn. The latch to the reverse lever that fits in the quadrant could have been worn. The valve could have been all rough and dry, so that maybe it jerked out of the quadrant. I never kept any record, but I will say that these things happened 25 times or more in the last 12 years that I have run on different types of engines. I reported these defects most of the time, and they were generally remedied (5434–5435).

G. B. HAYES, 64 years old, employed as hostler by the Atlantic Coast Line Railroad, testified:

I was a hostler on October 5, 1929. On that day I was hostling engine no. 444. It was equipped with a power reverse gear, I have forgotten the make. I put the engine on the storage track and set the pump down, and my helper had opened the drain cocks to the reservoir, and about the time the engine got down to 40 pounds of air he wanted me to slack back a little bit to spot for rod cuts so that he could fill them. I pulled the engine over and thought I had her reversed, but it seems there was not enough air pressure left to do it. I gave her a little steam and she started ahead, and I had no way to stop it. She went down off the end of the track and finally stopped at the bottom of a 10-foot hill. The engine did not turn over. The ground there at that time was soft.

(Motion to strike by complainant's counsel on the ground that foregoing narration shows no failure of power-reverse—Denied.)

WITNESS (continuing). That accident would not have happened with a hand-reverse. (This statement objected to as pure
1530 guess by counsel for complainants. Objection to witness giving reason for statement also entered. Examiner permits witness to answer.)

WITNESS (continuing). In my judgment that could not have happened with a hand-reverse because I had power to pull the link over with the reverse bar. Then I could have given it steam to act as a brake. I did not have enough air to apply the brakes. I tried it, but they would not apply. I thought I had enough air to set the brakes when I started to reverse the engine, but I did not have enough air to reverse the engine. I intended to back the engine and it would stop itself. I had intended to set the brakes, but I did not have anything to set them with. There were two big openings in the reservoir and it was all going out so fast it would not work. I went in the opposite direction to that which I wished to go (5435–5439).

CROSS-EXAMINATION

WITNESS (continuing). I did not start the pump on this engine. I thought I had enough without doing that, but the air went off so fast it left me helpless. I looked for it, but it went down so fast I did not have anything to operate with. This was caused by

1531 two valves on the main reservoir being open. It is the order to drain the reservoirs when you put the engine away, and we thought we had put it away. We had 40 pounds of air when we started, but there were two big holes in the reservoir running it out. I knew the openings were there, but I thought I could make the movement before they got down that low. That was a mistake of mine.

I do not recall seeing an engine which was equipped with manual reverse gear run off the track at Columbia. I did see the one previously mentioned after it was off the track and I know it did run off the track. It was caused by air failure. There was not room to stop it. I did not see the engine before it ran off the track.

(Motion to strike out this testimony sustained.)

WITNESS (continuing). I do not know an occasion where an engine equipped with manual reverse gear ran off the track or into a turntable pit. We have no turntable pit at Columbia. It has been covered up for the last 10 years. We built a coal chute there. I have had an engine with manual reverse go off the track, but due to some other defect besides the manual lever. I have had a case where an engine ran off the track or went into the pit because I could not stop it with the hand reverse. The grade was so heavy, and when you reversed the engine locked the wheels and slid right into the hole. We were going about 15 miles an hour. I came down to the cinder pit with an engine and stopped and operated the brake, and stopped at the pit, cleaned the fire, and started off, and after the engine got some speed, I applied the brake, but the air would not operate, but I could get my reverse bar over in a manual way,—it was

1532 at the end of a track. I examined the brakes and found there was a little piece of babbitt that got over the airport and would not admit air to the brake valve. When I reversed the engine, it reversed. It did what I intended, but the grades were so heavy I did not have time to make the movement. I had one case with the air reverse and one with the manual. With the manual reverse engine, I was so close to the end of the track when I reversed it that it did not do any good and it went on off. The same thing would have happened in that case if the brakes had taken hold. We were so close to the end of the track, and did not have time. The hand lever on that occasion did exactly what it would have done with the brakes if they had been working. The manual reverse bar did not stop the engine because it did not have time. You have got to give everything a chance. A man will grab at these things in an effort to save trouble even if he knew at the time it would not do it (5439–5446).

REDIRECT EXAMINATION

When I threw the lever in back motion on the engine equipped with hand reverse, it actually reversed the engine, but in the case of the air reverse gear-equipped engine, it did not reverse. I was

about 20 feet from the end of the track with the power-reversed engine. It was slightly down grade. We were going about 4 or 5 miles an hour.

RE-CROSS-EXAMINATION

There was an investigation of this occurrence when the engine with the power reverse ran off the track. I have my statement, if you would like to see it. I was disciplined five demerits; the reason for such discipline was, I suppose, man failure. I should not have started the engine unless I knew I had air. I took a chance.

There was no investigation of the occurrence when the hand-
1533 reversed engine went off the end of the track. Going through it, I found there was an impediment in the air pipe stopping the flow of the air and it did not give me any chance to use it. I was not held responsible (5447–5450).

REDIRECT EXAMINATION

When you have a hand-reversed engine, you have your reversing gear whether you have air or not. You do not have to take a chance with the air supply.

(Objection to the foregoing overruled. At this point witness was asked to state why he preferred the hand lever. Objection by counsel for complainants on the ground that it is immaterial what this witness's preference are, sustained.)

In answer to question by examiner as to whether witness had any other experiences other than the two previously mentioned, which involved either power reverse or hand-reversed gears, witness replies:

In general practice, I have had other experiences, but I cannot recall them at this time (5450 to 5453).

EDGAR EVANS, 43 years old, employed by the Delaware, Lackawanna and Western Railroad, testified.

I was first employed in 1902 as a machinist's helper. I was promoted to machinist in 1904. On December 1, 1929, between 10:30 and 11:00 p.m., there was an accident on engine no. 1612 at Scranton. This engine was equipped with Alco air reverse gear. I was sent down there to repair some cylinder valves by the foreman, and I started at the right back, and the valves were leaking, and I could

not get at it, so that I got up into the cab and shut the pump
1534 off. As I got up in there, Mr. Reed, the engineer, was in there and asked me what I wanted. I told him I wanted to shut off the pump, that I was working on the cylinder valves. He shut the pump off for me and I went down and repaired the right back cylinder valve, put it altogether, and crossed over and repaired the left front. The steam was pretty strong over there, so that I came along the left side of the engine hollering, "Look out for re-

verse lever on no. 1612!" I was going to change the movement of the valve, to get the steam into the back end of the cylinder from the front. I did not see Mr. Reed alongside the left side of the engine. He told me he was there, but I did not see him. I climbed up on the left side of the cab, crossed over to the right, putting my head out of the right side window and hollering, "Look out for reverse gear on 1612!" I threw the reverse lever ahead down to the front end of the engine. I came down over the left again to the front end of the engine, where I met Mr. Reed, and he asked me, "Who threw the lever?" I said, "I did." He (I?) said, "What's the matter?" He said, "You caught me." I said, "Where were you?" He said, "On the left side." I did not see him, but he went away to the roundhouse office and I proceeded on in repairing the cylinder cock at the left front.

I did not feel any obstruction, not a thing, when I moved the lever. I think the engineer's left hand was caught, the two middle fingers (5453–5456).

(Motion to strike witness's testimony as to what happened after he moved the lever, on the ground of hearsay, denied.)

CROSS-EXAMINATION

This occurrence was investigated. I was called in and reprimanded; told to be more careful; that is all I heard. It
1535 is our duty to be sure there is nobody around an engine before starting any of the parts, but I did not see him. I looked around on the left side as I went back and not seeing him I hollered out of the cab on the right side of the engine. This occurred between 10:30 and 11 at night. The engine was scheduled for 11 o'clock, I think.

(A question as to whether, if same situation were presented today, witness would begin to operate the air mechanism without first being sure where the engineer was located, objected to by counsel for defendants as irrelevant and immaterial. Objection overruled.)

(Witness continuing, answering above question.)

I would call out and notify him I was throwing the lever the same as I did before. The engineer did not answer when I called out.

(The question as to whether witness at the present time would just holler and move the mechanism even if he did not hear the engineer reply, which was answered in the affirmative, ruled out by examiner.)

(Witness continuing.)

If the engineer had been equipped with manual reverse, I do not think the accident would have been quite so severe. Only two of his fingers were caught. The hand gear is not quite so sensitive as the air reverse. I do not think his fingers would have been mashed, they might have been bruised. The engineer was laid off for about three months on account of this accident. I do not think he lost his

fingers, but I do not know the full extent of his injury (5456–5461).

(At this point, copy of report to the Interstate Commerce Commission of the foregoing accident offered and received as exhibit no. 68.)

1536 E. B. HALL, general superintendent of motive power and machinery of the Chicago and North Western Railway System (including the Chicago, St. Paul, Minneapolis & Omaha Railway Company), testified.

Entered service as enginehouse man on the Chicago and North Western Railway September 1889. Entered service as locomotive fireman in 1892; promoted to position of locomotive engineer in October 1898 and continued in service as such until 1907, at which time was promoted to position of road foreman of engines with headquarters in Iowa. In 1910 was promoted to the position of master mechanic with headquarters in Iowa. In 1912 was transferred as master mechanic with headquarters at Chicago. In 1914 was promoted to the position of assistant superintendent of the Wisconsin division in the operating department, with headquarters at Milwaukee. In 1919 was promoted to the position of assistant superintendent of motive power and machinery with headquarters at Chicago. In 1920 was promoted to the position of principal assistant superintendent of motive power and machinery of the North Western System, with headquarters at Chicago. In 1922 was promoted to the position of superintendent of motive power and machinery of the North Western System, headquarters at Chicago. In September 1927 was made general superintendent of motive power and machinery of the North Western Railway, and in 1929 the Chicago, St. Paul, Minneapolis & Omaha Railway was added to my territory.

In working as a locomotive engineer from 1898 to 1907 all my work was with hand-operated reverse gears. I never was injured, and do not recall any instance of a lever having gotten away
1537 from me or going into the corner; nor do I recall any instance where the lever itself became unlatched and moved to the corner—the so-called jumping out of the quadrant. My practice in handling the reverse lever was in general similar to that testified to in this hearing by a number of engineers from our railroad. In general, I usually used only one hand. In road service in adjusting the lever to different points of cut-off– so-called hooking up or letting down process—I used only one hand. However, on those infrequent occasions when through lack of proper lubrication of the valves or other binding of the working parts the lever handled harder than ordinarily, I then used both hands. I found that any conditions causing the lever to handle more stiffly than ordinarily were readily known to me in advance of the sound and feel of the lever and I was accordingly prepared to use, and did use, two hands and more strength than ordinarily when necessary to meet such conditions. I experienced no danger to myself and no undue physical exertion

in so doing. Since I left active service as an engineman I have from time to time operated locomotives equipped with hand reverse levers, including every class and type of locomotive now in service on our line so equipped.

While road foreman of engines and master mechanic, I rode and operated all of our various types of engines very extensively, and I have done so occasionally right up to the present time. I have not experienced any material difference in the operation of the hand reverse gears now on locomotives on our line as compared with conditions when I was operating as an engineer and during my period as road foreman of engines. To the extent that some of our locomotives now in service with hand reverse levers are larger and have larger valve motion parts, this has been compensated for by larger counterbalance springs. In common with all other railroads
1538 we have, on our line, been gradually improving our care and efficiency in the maintenance of these hand levers along with all the other parts of the locomotives and other equipment, so that our locomotives are maintained today at a considerably greater state of efficiency than they were years ago, although lack of funds at the present time on account of the current depression threatens our ability to maintain this increased degree of efficiency. The various working parts of the valve motion of locomotives newly out of the shops are fitted more perfectly and put together with more care than they were years ago, and ordinarily it takes very little adjustment, and a comparatively short breaking-in period to make these locomotives ready for regular service. Such adjustments as may be necessary in any case in order to make the hand reverse lever work freely are readily and easily made either by the engineman who is breaking in the locomotive, or by the shop or enginehouse forces, and there is no reason whatsoever for a hand operated reverse lever being permitted to remain in condition where it will cause an undue amount of exertion on the part of the engineman who have to run the locomotives.

In my experience, both as engineer, road foreman of engines, and up to the present time, I have found on our locomotives equipped with hand reverse levers on our railroad, that there is plenty of room for me when acting as the engineer to conveniently operate the locomotive, using the hand reverse lever, throttle, braking valves, and all of the other controls necessary for the engineman to use. My height is six feet; weight 235 pounds. The hand reverse lever is in no sense a dangerous instrumentality, being simply one of the many parts of appurtenances of the locomotive. The lever itself is in the nature of a simple tool like a hammer or a bar, and like any
1539 tool or piece of machinery a man may injure himself in handling it if he does not exercise ordinary care. Such injuries as have occurred with the hand reverse lever on our line have been minor in character, and practically in all cases have been caused by failure of the injured man to exercise ordinary care.

To protect men against any careless tendency to brace their foot on the boiler head in a position where it would be caught in the event they let the lever get away from them, in recent years we have given particular attention to providing proper clearance around the levers, both on the forward position as between the lever and the boiler head and various pipes, and other appurtenances, and in the rear position between the lever and the back board of the cab, and we have put braces conveniently located outside of the quadrant, so that there is on our locomotives no occasion for the men injuring their hands, feet, legs, or arms, if they will handle the lever in the ordinary convenient and intended manner.

As far as keeping a lookout for signals, highway crossings, or obstructions is concerned, the handling of the hand-operated reverse lever in no way has ever interfered with my duties of keeping a lookout, in my experience, nor have I ever observed it doing so with any other engineman. The amount of attention necessary to give to the operating of the hand lever as compared with operating the control of the power reverse gear, I have found to be practically the same. As a matter of fact, neither one of them requires enough time or attention to interfere in any way with the duties of keeping a lookout.

During all of the time that I have ridden on locomotives beginning with my first experience as a fireman, I have never observed a hand lever jump out of the quadrant, nor can I recall ever having
1540 seen it pull or get away from the man who was operating it on any locomotive that I have ridden, and I ride them frequently, even up to the present, and rode them practically all of the time when on duty as road foreman of engines, and a great deal when I was master mechanic. I am aware that these things happen sometimes, but based upon my experience, it is my opinion that they happen very infrequently, and I am sure that any engineman of ordinary skill by using ordinary common sense and being reasonably alert in the performance of his duties, will avoid either one of these occurrences. Furthermore, the lubrication, adjustment, and maintenance of the various parts are subject to the control of the engineer to such an extent that he can very largely control the ease of operation of the hand lever and thereby guard against any conditions which might result in the jumping out of quadrant or pulling away from him (5462–5468).

My recollection is that power reverse gears were originally applied to Mallet type locomotives; that is, locomotives having two complete sets of cylinders and running gear. Later equipment manufacturers began to design and push these power reverse gears for application on the larger modern types of other locomotives. The manufacturers of various power reverse gears claimed that their application would result in the engineman maintaining a finer point of cut-off with more frequent adjustments of the valve gear, which would result in more economical performance of the locomotive with

a material saving in fuel. As far as I know, none of the manufacturers ever contended that the installation of power reverse gears would promote safety in any way, and I know from our own standpoint in applying them we have never at any time considered that safety of operation of the locomotives, or safety in any other respect, would be prompted by putting them on.

1541 Our experience with power reverse gears began in 1913, when we purchased 15 class J Mikado locomotives, weighing 229,500 pounds on the drivers, equipped with the so-called Mellin power reverse gear. We subsequently bought 45 more of these locomotives, 19 of which were equipped with the Mellin gear and 26 with the Ragonnet.

The Mellin gear was operated upon the same general principle as the present power gears, having, however, two cylinders and two operating valves controlled by a long operating lever located in the same relative position as the hand lever in the engine cab. These gears gave us considerable trouble in the matter of maintenance at all times, provided to be very undependable, and so unsatisfactory that in 1923 and 1924 we removed them all and replaced them with the Alco gear, which had been developed in the meantime and appeared to offer promise of more satisfactory performance.

The one Ragonnet gear applied in 1914 appeared to give better results than the Mellin gear, so we equipped 156 class J locomotives subsequently purchased with that type of gear. While we experienced less difficulty with the Ragonnet gear than with the Mellin gear, a different type of trouble was experienced, which in our opinion indicated that the Ragonnet gear was not yet perfected and accordingly we experimented with other gears available at that time—the Lang gear—similar in design to the Ragonnet, except for the method of admitting air to the cylinder, and a gear developed on our own line known as the Helmholtz gear, and which was later taken over and further developed by the Barco Manufacturing Company.

In 1921 we purchased 40 additional class J locomotives with the Alco gear, and between 1922 and 1923 we purchased 178 class J
1542 locomotives equipped with the Barco gear, each change being in an effort to obtain the most satisfactory power reverse gear available at the time.

All of our locomotives purchased in recent years have been of the heavier type in line with the tendency in design of modern locomotives, and we have purchased them equipped with either Barco or Alco power reverse gears. In addition to this we have equipped 251 consolidated type locomotives known as our class E, weighing 209,500 pounds and 214,500 pounds on the drivers, and 41 class E Pacific type passenger locomotives weighing 168,500 pounds on the drivers with Barco and Alco power reverse gears.

Our experience with all of the power reverse gears in use on our line has been that our maintenance cost is very much greater than

the cost of maintenance of hand reverse gears. Enginemen frequently report "creeping" and various other defects of these gears. I have given a great deal of study and attention to the matter of these gears on our own line, and have carried on a great deal of investigation as to results on other lines, and have found that no power reverse gear has as yet been made which will give a continuous positive control of the locomotive valve that can be depended upon under ordinary conditions of operation. Creeping has been experienced with all of them, and while the more improved types will give reasonably satisfactory performance for a time, the slightest wear or misadjustment of any one of the numerous parts going to make up the mechanism results in defective performance and necessitates maintenance work being done. Furthermore, it is oftentimes impossible to determine just what is the cause of the creeping or other defect. I have had this up with the various manufacturers of these gears and have had their men ride our locomotives, and we have co-operated in trying to overcome these difficulties but
1543 have been unable to overcome them up to the present time, and are still working on the problem.

Our experience in the operation of these various types of power reverse gears in use on our line has not justified the claim of the manufacturers, nor our hopes and expectations at the time we put them on. As stated above, they cost more to maintain and we have not benefited by more economical locomotives performance or saving in fuel by reason of this equipment; nor have we experienced any greater efficiency as regards the amount of work done per locomotive by application of these power reverse gears. The amount of time required to operate the hand gear and the power gear, generally speaking, is not materially different. In other words, there is not enough difference between them under ordinary conditions to have any effect whatsoever on the amount of work done. The hand lever in emergency can, however, be operated more quickly than the power reverse gear, and with a hand lever you have the additional safeguard of being able to use it for braking purposes in the event of failure of the air supply or for other reason the air brakes become inoperative. While the more modern types of power reverse gears have an auxiliary steam supply designed to cut in in the case of emergency, a breakage of the supply pipe to the valve operating reverse gear necessarily results in loss of control of the reverse gear, whether being operated by steam or by air, and in various circumstances situations arise where an accident can be avoided by use of the hand lever for braking purposes where there is not sufficient time to cut in the auxiliary steam supply where the air pressure is not sufficient for operation of the power reverse gear.

On engines equipped with power reverse gears we have experienced several different types of accidents which we have
1544 not experienced on engines equipped with hand levers. I refer first to the cases where engines moved through engine-

house walls or into the turntable pit because of the operating lever of the power reverse gear being set to move the engine in one direction while the valve gear itself was actually in such position as to cause the engine to move in the opposite direction because of insufficient air pressure in the air supply to the reverse gear cylinder, or because of creeping of the air reverse gear. Accidents of this kind do not happen with the hand reverse lever because the position of the lever in the quadrant positively indicates the position of the valve gear, and hence indicates the direction in which the engine will move when steam is admitted to the cylinders, and the valve gear can not creep when held by the positive and direct connection of the hand lever.

The second clas of accidents occur where men are working about the locomotive and when the air pressure is being pumped up, or because of creeping or other defects of the power gear, the valve gear moves without warning, and the man is in a position to be caught by such movement and injured.

The third class of accidents is where men have been similarly caught and injured upon the intended movement of the operating lever of the power reverse gear in the cab by another employee. Because of the inherent difference between the power reverse gear and the hand lever, this same type of accident is most unlikely and practically impossible to happen with the hand lever. Because of the fact that the operating lever of a power reverse gear must be moved first before the air is admitted to the air cylinder, which causes the reverse gear to be moved, the movement of the valve gear parts themselves does not begin immediately with the move-
1545 ment of the lever in the cab as is the case with the hand reverse lever. However, after the operating lever of the power reverse gear has been moved a given distance, the full force of their air pressure then automatically moves the valve gear parts to the full extent that the operating lever has been moved and there is no stopping that movement at a half way point, or at any other point until it is completed, whereas the operator of the hand lever has the extent of the movement under his control at all times. The force of the air in the power reverse gear is also considerably greater than the force exerted by hand-lever operation and in ordinary hand-lever operation a comparatively small amount of force is used. These distinguishing features between the two types of gears indicate to me the reason why we have experienced fewer types of accidents with the hand lever on our railroad.

A fourth type of accidents has resulted from the fact that the power reverse gear does not hold the locomotive valve gear in the desired adjustment while the locomotive is in motion. This characteristic of the air reverse gear is generally known among railroad men as "creeping." It sometimes happens that these gears permit the adjustment of the valve gear to creep back to a point where the steam is trapped. This throws a terrific strain on the entire operat-

ing mechanism of the locomotive, and especially on the valve gear, and on account of same we have experienced breakage of parts and locomotive failures and delays.

The estimated average cost of applying power reverse gears to the locomotives on our railroad, which are now equipped with hand levers, is $490 per locomotive. This is the estimated cost prepared by our mechanical engineer under my direction and instructions, and is based upon current cost of material and labor. It is borne out by the cost which we experienced in equipping various of the locomotives above mentioned upon which we have installed these devices.

1546 In view of our unsatisfactory experience with power reverse gears and the fact that there is yet a lot of development work to be done if they are to effectively fulfill the purpose for which they have been designed, I do not feel that the Chicago & North Western Railway Company would be justified in expending any money at the present time in putting on more of this equipment (5468–75).

(A question directed to witness as to what has been the effect of the current business depression upon the Chicago & North Western Railway and the business handled by it, objected to by counsel for complainants for the following reasons: It assumes something that is not in this record. It assumes that there is a business depression. For the purposes of this record, there is no business depression. It is improper to presume into the record that there is one. No ruling by examiner.)

WITNESS (continuing, in answer to question by examiner as to whether he has any personal knowledge of a decline on the North Western). Yes, sir. I get the daily loading reports in my office and I get other statements furnished to the general manager, and I sit in with the general manager in his meetings on finances, on adjusting budgets, wherein my budget is fixed for the maintenance of power. In addition to this, I get a monthly statement from the general manager showing operating conditions, the falling off of our business by territories, and where the reductions have been or have not been sufficient to balance the decreasing business, such as engine-house expense. I have no personal connection with the financial operations of the railroad other than consulting frequently with the men who make up the statistics, such as our statistician,

1547 the general manager, and the operating vice president. I have an official duty in connection with about a million dollar-a-month pay roll which is allotted to me. My connection with the financial department does not extend any farther than the allotment of the appropriation for running the mechanical department. Aside from the avenues of information already mentioned, there are other sources which enabled me to know how the amount of traffic handled at the present time compares with previous years. I get the loading reports which give the daily report of business handled on

each division. In addition to that, we are required to furnish power of various classes to handle the various business of the divisions, and sometimes we have to raise questions on account of the reports indicating a big falling off of business, and their asking for additional classes of powers. That is handled jointly with the assistant general manager in freight service.

To some extent the number of locomotives in service reflect business conditions on the road in that there is a lesser number of locomotives in service, I would say 15 or 18 percent. It varies considerably—not to the extent that your business would be off, but by reason of arbitrary trains, where you cannot hold for traffic. The number of locomotives in or out of service does not tell the whole story. We have a lot of arbitrary trains that have fixed times of arrival at the various terminals, that you cannot hold for tonnage. If we could hold for tonnage, we could reduce our engine hours considerably.

(At this point, in view of the objection by counsel for complainants, counsel for defendants offers to withdraw question as to witnesses' knowledge of the fact of the business depression on the Chicago and North Western Railway.)

WITNESS (continuing, answering question by counsel for
1548 complainants). As general superintendent of motive power and machinery, it is part of my duty and business to be acquainted at all times with the general conditions respecting the handling of traffic, that is, volume as well as character of traffic on the entire North Western System. Carloadings are not under my supervision, but reports come to me daily. The general superintendent's office gives every department interested that information.

(At this point, counsel for complainants insists that witnesses' knowledge of business on the road is pure hearsay.)

WITNESS (continuing, in answer to question by examiner as to how he knows about the business on the North Western other than from demands made for power by the transportation department). I am on the road—I would not attempt to say how much, because it varies, but I cover the territory very frequently. I have just come in from a trip, and on those trips I even check train sheets and check operations and report to the general manager, which I did on my last trip, some improper operations of the operating department on a certain run where the merchandise was not being gotten into a terminal, because the superintendent was trying to get a good tonnage in a territory, and are making those check-ups on the various divisions with the superintendents. I know just as well as they do what business they are handling. I have to know if I am going to properly assign power or assign payrolls to that territory to main-power. If I did not, I would be assigning power which was not necessary for the service. Quite frequently we find locomotives in service that we required to be tied up serviceable, because we have not got sufficient demand for that number of

engines. I cover the system as a whole, except the Omaha. I do not check into that particular feature on the Omaha. Mr.
1549 Gorman handles that. I have not gotten that far since I got the position. I have had too much to do (5475–5481).

(Counsel for complainants contends that witness has obtained his information by an observation, and urges that this does not constitute a foundation for testimony on a matter susceptible of accurate, reliable testimony by some witness whose duty it is to know the facts. Witness permitted to proceed.)

WITNESS (continuing). From my knowledge and information of the present situation and of the situation which has existed over the past several years, I know positively that there is a big decline in the amount of business handled at the present time on the Chicago and North Western, as compared with what was handled in 1929, 1930, and previous years. I must know that in order to bring about the reductions that I am compelled to make.

(Witness directed to give figures, in a general way. Counsel for complainants objects to witness testifying as to revenue figures or the profit or loss out of the loss of business. Examiner permits witness to testify, indicating to counsel for complainants that he can subsequently make a motion to strike.)

WITNESS (continuing). The business reduction is much greater than our reduction in engine-house forces up to the time we closed our last shop. We made close to 10-percent reduction in engine-house forces, in shop forces, in 1930, and the business is off nearer 30 percent. This 10-percent reduction is comparing 1930 with 1929. The reduction in our round-house forces, which includes engine-houses and shops, in 1931, as compared with 1930, was a little better than 16 percent. We have 7 shops on the North Western. None of them are running now. Only one has been running since March and that was closed on September 1st. All were running
1550 in 1929 except the one at Kaukauna. We closed that by piecemeal, and finally, in 1929. There was no connection between that closing and the decline in business. It was a case of reducing our overhead, too many shops for the number of employees that we were able to maintain. The reason for closing the other shops was lack of funds due to the decline in business. The gross operating revenue was so low that the manager said he absolutely could not get the money to carry out our budget and that we would have to reduce. The only way we could reduce was to reduce shops, because with the trains operating we had to maintain at least a minimum force.

(At this point, counsel for complainants moved to strike witnesses' statement with respect to reduced operating revenue as being the reason for the reduction in the amount of money allocated to him, on the ground that the reason for the reduction of the allotment to witnesses' department should come from somebody else.) (Witnesses' testimony permitted to stand.)

WITNESS (continuing).

The reductions which I have made affected the supervisory forces as well as the hourly paid forces. We reduced foremen and master mechanics. With respect to our supervisory organization, we have consolidated and placed larger territories under one master mechanic, in order to reduce our overhead, to get down so that our overhead would be somewhere in line with our present force. In that way we have eliminated three master-mechanic positions.

Engine-house forces were previously reduced down to a point where we could just properly maintain running repairs, and do some light repairs, such as dropping a main pair of wheels. We could not take on a heavier work. We could not make further re-
1551 ductions at those points without losing too much of the general condition of the power. We have been making these reductions in the roundhouse forces ever since 1929. Wherever we can pick off a man or two without hurting too badly, we do so. Our purpose in doing this was to reduce our expenses in line with the money we are able to earn, so that we do not overrun the budget. These reductions have resulted in a decrease of 26 or 27 percent in the number of employees in my department at the present time, as compared with 1929 (5481–5486).

We have taken other steps to save money, other than the reduction of forces, in the items going to make up the cost of maintenance of equipment. We are purchasing less material, lot less material. We are reducing in every way possible. We do not buy a single thing that is not absolutely necessary. A master mechanic cannot get a requisition thru without my personal signature and I am held responsible if anything is ordered that we can get along without, and there are plenty of them checking it. We are not approving any requisitions for new devices or appurtenances to be installed on our power at the present time. Except for a change of cylinder cocks, we have not approved such requisitions for a year and a half. I had to make a change in the cylinder cocks on the larger power, which was a replacement proposition of a minor nature. I do not recall any other at this time. I cannot think of anything, from an economic or financial standpoint, that would justify our approval at the present time of requisitions for power reverse gears on locomotives which on our road are equipped with hand levers. We are making every effort to keep our expenses down and save enough money to pay the interest on our fixed charges so that our bonds will be negotiable and we won't go into the hands of receivers.

1552 (Motion by counsel for complainants to strike out reference to bonds and receivership, sustained.)

(Question as to whether or not witness knows that the net income on the North Western has been sufficient to equal the proportionate interest on funded debt for the first eight months of 1931, objected to by counsel for complainants. Objection sustained, until witness has shown himself qualified.)

WITNESS (continuing, in answer to question by his counsel as to whether it is part of his business to be informed as to the net income of net earnings of the Chicago and North Western Railway). It is part of my business. I talk to the general manager, the president, and the statistician. I do that so that I may have the necessary information to put up the proper argument, for one reason, to get the pay roll for our power. If I know the conditions all the way down the line as to earnings, etc., I am in a better position to know whether or not I should insist on additional pay roll.

I would not say that I was in a position so as to know all the information from time to time with respect to net income and accrual of interest charges on funded debt, but when I have contact with the president and others on pay roll, I am invariably informed as to where we stand on the interest on our fixed charges. With respect to these matters, I had an interview with the president and also with the statistician within the last ten days. The statistician had the reports which were made to the Interstate Commerce Commission, but the president informed me of the situation verbally.

(At this point, counsel for complainants objects to witness further testifying as to whether or not the net income of the Chicago and North Western Railway Company has been sufficient to equal
1553 the accrued or proportionate amount of interest on the funded debt of that company on the ground that witnesses' knowledge is based upon what the president or the statistician told him.)

(Counsel for defendants takes the position that witnesses' testimony is based upon matters of public record.)

(Examiner expresses opinion that testimony along this line is outside the scope of witness's bailiwick after a series of questions by examiner with respect to the computation of net income, which witness was unable to definitely answer. Complainants' objection was sustained (5486–5492).

WITNESS (continuing). With respect to the engines which were changed from hand levers to power reverse gears, I think the class Z engines were the ones changed over. Some years ago somebody on the road used one of the class Z engines in switching service. There were agreements made by the organizations and the general manager gave the order that they would not be used in switching service. That is, when they first came to us. They were originally purchased for road service. A number of years later, it developed that we either had to buy some larger switching power or use these particular locomotives in switching service, and we got the organizations to agree. By applying power reverse gears and cutting the coping off of the tanks of the tenders and putting on foot-boards, they could be used in switching service. By "the organizations", I am referring to the complainants' in this case. The matter was handled with local committees, with our vice president in charge of personnel, as I recall it. It was the only way we could get away from buying locomotives. We did buy eight. The men requested

that the power reverse gear be put on if we used them in switching service. Under the circumstances, I think the request was
1554 reasonable. I think we had requests for power reverse gears on those engines while they were in road service. We had a request of some kind for power reverse gears and I think they were included. I have had experience handling the Z engines, riding on them and running them occasionally; also when they were equipped with hand levers when I was acting as road foreman for engines. I never encountered any difficulty in handling them nor do I know of any other engineers who did. It was advantageous to get these engines in the switching service, because by getting larger engines assigned in certain switching territory, we were able to eliminate jobs, pull off shifts of switchmen and engine crews, and in some places where we could do that, we got greater efficiency, handled more cars in a lesser time with less expense. They were heavier engines. They weighed from 209,500 to 214,500 pounds. The engines we were previously using were R–1's and M–1's. The M–1 weighed 124,000 pounds and the R–1 weighed 127,500 pounds.

I do not think that the original agreement that these Z engines would not be used in switching service was so that the number of jobs would not be reduced. I do not think that was taken into consideration at all. At the time that proposition came up, as I recall it, they were our largest engine, and we thought we had the biggest engine we would ever have, and would not need them in switching service, and would keep them in road service. Now it develops that they are nothing more than a branch line, or transfer or switch engine. That is practically all they are used for. The change on those engines from hand to power gears was not to promote safety of operation. That was not considered. We have no program at the present time for equipping any more engines with power reverse gears. I do not think that the locomotives on the Chicago and North Western now equipped with hand reverse
1555 levers would be made safer to operate by equipping them with power reverse gears. I do not think the question of safety enters into it. In my opinion, the safety of operation would not in any way be promoted by putting power reverse gears on those engines on our road that are now equipped with hand levers. I can handle a hand lever and observe signals or I can handle a power reverse gear and observe signals, one equally as well as the other, with practically no difference. I run engines on practically every trip I take over the road, in some class of service. I cannot see from any standpoint that safety would be promoted in any way by putting on power reverse (5492–5496).

1556 CROSS-EXAMINATION OF E. B. HALL

There is practically no difference in the operation of the hand reverse on a light engine as compared with a heavy engine because the difference in the weights of the parts is compensated for by a

larger counterbalance spring. Originally the power reverse was applied to Mallet engines. With respect to the 15 Mikado locomotives which we purchased, equipped with power reversing gear, we didn't have the manual reverse gears on these on account of the construction and the clearance, and the fact that the power reverse gear was coming onto the market and lots of statements were being made as to the economies that could be effected, and we tried out the power reverse gear. At that time we got 15. Our experience with those 15 power reverse gears was about as at the present time. We had trouble with the Mellon (Melline?) gears in different ways. We finally removed most of them.

In 1913 I was master mechanic of the Wisconsin division, located at Chicago. At that time it was not within my province to decide whether an engine should have power reverse gears or not. I think we were in on a conference at the master mechanics meeting, but I think what we said did not have much bearing on what we would or would not buy. The reports or information that I got with respect to those 15 power reverse gears—they were only operating a few of them on my territory—was we had trouble with the gears in holding the valve motion where it should. I get my information now from reports. At that time I was closer to the game than I am right now but the information was about the same. I would not say that I learned definitely that the 15 engines purchased in 1913 would not maintain a proper cut-off. They did not maintain their proper cut-off at all times, and we were working on them at all times hoping to overcome the trouble. Our experience was not up to expectations and as a result they were wasteful of fuel to some extent. They are wasteful to about the same extent now. We have taken off some of them and have put on either the Barco or the
1557 Ragonnet—I have forgotten which. In 1914 we got better results with the Ragonnet so we purchased 156 class J locomotives equipped with that type of gear. On account of the clearances and a simpler method of application, the power gears were used instead of manual gears. Beause of the wide fire box it was hard to put the hand reverse gears on that class of power. It was not impossible to put on the manual reverse gears but impractical on account of the clearance, that is, to get the reverse gear in without an off-set in the arm that holds the bottom end of the reverse rod. The off-set would be hard to maintain because the leverage is not direct, it is from an angle. We have had that condition and have had difficulty in maintaining the off-set connection. As to whether we has as much difficulty with that as with leaky packings, I don't know that I ever measured it. We had difficulty with maintaining it all of the time. I couldn't say whether it was reported every trip and I cannot remember whether there was constant complaint about it or not. I know it was reported quite regularly and every time it went into the shop there would be a lot of work to do on it. Such as, rimming out the holes, the bottom end of this arm, where the

bolts go through the frame, applying new bolts, and refitting the bearing at the bottom end of the reverse lever. That is just as big a job as taking the packings out of the air piston. I do not have any figures to show what it would cost to rim out the holes and put in the bolt, but I do say it would cost as much.

The off-set would not have interfered with the operation of the manual lever. It might make it work a little harder. That could be off-set to a certain extent with a counterbalance spring. We have taken the power reverse off of some of the 156 class J locomotives but I cannot tell you how many. We didn't put on the manual lever. We put on either the Barco or the Alco,
1558 so that we have not abandoned the power reverse on the class J engines. I heard the fuel supervisor of our road testify that creeping valves caused an increased consumption of fuel, but I do not recall that I heard him give the percentage. If he testified that the increase was 20 percent, I would agree with him, because I think he has the figures to justify that statement. We did not leave the power reverse on the 156 class J locomotives, resulting in a 20 percent waste of fuel and large expense for upkeep simply because the hand reverse would have been a little harder to operate. We left the power reverse gears on because it would have cost a lot of money to take them off and because it is impractical to put hand reverse levers on that large power. Impractical, as previously stated, on account of the clearances. I did not say that the only difficulty would be an off-set. It can be put on, but it is impractical to put this on with the off-set arm on account of the clearance in the cab or on account of the clearances on the side of the boiler, to give clearance between the man and the cab and the lever, or, if you put it beside the boiler, between the boiler and the cab. You have to have a certain amount of clearance and in my opinion there is not room enough for that kind of application on that class of power (5497–5504).

We have 310 class J locomotives equipped with power reverse gears. I would not say that there is anything about the design of these class J locomotives that would compensate for the loss of 20 percent in fuel in their operation due to the power reverse gear. That is, if they lose 20 percent all of the time. But I question the statement of losing 20 percent every minute of the time they are operating.

(Short discussion at this point between examiner and counsel for complainants with respect to the accuracy of the 20 percent loss in fuel consumption; also with respect to figures to be furnished by the North Western with reference to coal consumption.)

1559 WITNESS (continuing). I got the statement from the fuel supervisor. And they haven't made any such statement to me as to any great percentage of waste, except on some particular trip. There is a lot of creeping with power reverse gears. I could not tell you that I check the reports every day or get information every

day. I would not attempt to say what amount of mileage is effected by creeping. They creep sometimes on some trips part of the way over the road, and at other times they will not. I would not attempt to give any figures on mileage. I think there is more creeping in the faster service. But you also have it in the slow freight service in southern Illinois where we have a speed limit on our heavy freight trains. We have the creeping and get the reports. I think it is easier to take care of and easier to overcome by the man changing his lever and hooking back, than it is in the faster service. Creeping is as bad a problem in the slower service as in the higher first-class service. In the slower service your engines are working with the longer cut-off and it is easier to overcome with the longer cut-off. I would not say that creeping affects our train schedules to a noticeable degree, if a man takes advantage of them when they are creeping, except where a man is working the engine at too short a point of cut-off and he traps the steam and breaks something. That is general operation. We have those things happen. It is present to such an extent that it sometimes interferes with the carrying out of the schedules in the fast service. We have had them break down because of a creeping gear with a man working the engine with too short a cut-off, trapping the steam and breaking some part of the valve gear. Occasionally, we have engines break down from other causes. We may have a rod break. We have had creeping seriously interfere with train schedules in fast service to the extent that they had to remove an engine from service in the fast passenger service. I can not give you the date and the engine, but they have had it.

I would not say whether it is one or more. I know of one, and
1560 I know of others where they have broken down. I would call the occasional taking of an engine out of service an interference with keeping up train service. If an engine broke a rod and had to be taken out of service I would say that the train schedule had been broken down on that particular trip. The fast service to which I have referred where we have had creeping, is between Chicago and Omaha and between Chicago and the Twin Cities. These are passenger trains, also some freight trains. They run on schedules. I can not tell what percentage of our passenger trains they been behind schedule between Chicago and Omaha during the past six months, nor have I any records here as to what percentage was due to creeping valves. I think we are greater than 98 percent on time on most of the jobs. That is, taking into consideration all the service. I only know of one run last month that I have the figures on. We had two delays on one run last month that I had to answer. That is the fast mail. I know we were late twice on that run.

I don't know how many engines we had during the past month or how many runs were made on the whole system. I don't count them. There were a hundred but I don't know how many hundred. The North Western prides itself on the fact that its trains run up to schedule, but that is no sign that we do not have trouble with these

delays. We are not always on time—not 100 percent. Creeping power reverse affects train schedules to this extent that engines have been cut off in the middle of the trip and some other engine would go on and make up the time, and if we make up the time we are charged with an on-time movement. I do not know when we last had an engine taken out of service on account of a creeping valve. When I said that we often times take an engine out of service I wouldn't say on account of creeping valves, but on account of a delay or something wrong with the engine. Quite often we will have something happen to an engine and it has to be removed. Creeping
1561 power-reverse is not the only thing we remove an engine for. We had a case recently, as I told you, when an engine was removed on account of power-reverse. It was west of Chicago somewhere. That does not happen very often. Our men are educated so that if they have difficulty and trouble they will be able to get in without failures (5504–5512).

I have not made much of a claim that there is anything in the new design of the locomotives that compensates for loss of fuel on account of creeping power-reverse. There is a claim because if we maintain them and the engine man is alert and changes the travel of the valve as the valve creeps, he can go along without wasting much fuel with the creeping power reverse gear, which they are instructed and ought to do. If they give a power reverse gear a notch and she does not take it and they give her another and she takes three, that engineer, if he is on his job, will hook her up and work here there for a while, and when it changes, he will change it. I would not say that the creeping of the power-reverse simply requires that the engineer give her closer attention than the hand lever. But it also causes improper cut-off a great deal of the time. If the power-reverse operated perfectly, I wouldn't say that you could have finer adjustments than you can have with the hand lever. You can make the notches just as fine on one quadrant as on another. We have done this on some engines but do not do it generally. If the air was operating properly you could have finer adjustments.

These large engines with the wide fire boxes have a greater tractive effort and haul heavier trains. I would not say that they run faster than some of the others. That is true of freight as well as passenger service with one exception. They have light engines in freight service that make just as good time as the heavy engines. By the introduction of heavier power, and the wider fire boxes, we
1562 have speeded up our freight movement. But you cannot run the heavier engines over all territory on the North Western system. We have had to use smaller power in territory where the track conditions and other facilities would not permit of the larger power. And they have just as fast schedules as we have on the main line. We use smaller power there and have smaller trains, naturally. Large power, where it can be used to advantage, and

get the tonnage, produces greater results. Larger power gives a lesser cost per engine hour if you have the tonnage than a smaller engine, because your wages are so nearly equal that the little difference doesn't make much difference in salaries, and additional tonnage reduces your cost. I would say that there is very little difference in the amount of time required to reverse the engine with either the hand lever or the power lever. It is not a common practice to use the manual lever for braking purposes. It is used sometimes when there is something wrong with the air; when you haven't got the air and you haven't got it pumped up and you have to move an engine or something happens and you want to stop. It would be used with a light engine or with a train if something happened to the air. It would be an emergency operation. I do not know of such instances in late years. I know of instances at the time that I was in the road service a few years ago when we didn't have the air and it was a common practice to use the hand lever occasionally. With respect to my previous testimony as to the power reverse creeping back to the point where the steam is trapped that means that the reverse gear will practically creep up to the center; far enough to trap the steam in the cylinders. There is quite a little difference between steam being trapped in that manner and steam being trapped by throwing the manual lever back in the case of an emergency. If you move your reverse lever your valve is working in conjunction with the piston in your cylinders and if your power reverse gear creeps enough to trap the steam, something has to let loose if it traps it entirely. It generally will break some part
1563 of the mechanism. It will blank the ports. We have had statements where men say they have reversed the engine. I haven't seen a case of that kind. I have investigated cases where we broke lap and lead levers or an eccentric rod. The only cases I know of where the engine reversed itself are the two cases reported here by witnesses Olson and Sommers. If a train was moving forward and in an emergency the engineer undertook to grab the manual lever and throw it into reverse, that would not trap the steam. If you threw her into reverse she would be working against herself and using it as a brake. It might slide the wheels and do lots of things, but it wouldn't trap the steam in the cylinder. If the wheels kept revolving it would build up high pressure. If the wheels reversed it would exhaust just the same as if it was going the other way—with the wheels slipping. It would place an extra strain on the valve motion parts if he throws the motion in reverse at high speed. It is not a good thing to do. Unless I wanted to use that pressure for braking purposes, I would not do it, nor recommend it. It would not be good practice. You might slide your drivers and do lots of things. I do not think it would tear off the driving rods. You might possibly strip it, but I doubt it very much. Unless there was a reason for it I would say it would be unwise, but if there was

a reason it would be necessary to do it even if it did break down the engine. It would depend upon which was the greater danger, whether he was going to run into something, or run off the derail, or hit some train in the crossing, or break down the engine. In those cases I would break the engine. I would stop if I could. There is not very much danger in breaking down an engine that is running, that is, so far as personal injuries are concerned. If it broke you might break the lap and lead lever or some part of the valve motion, or knock out a cylinder head. I think the stresses on the rods are so great that they should not break. We might have had cases where men were hurt when the cylinder head was
1564 knocked out. I don't know of any cases of that kind. I never head of one on the road, but I have around a yard or some place switching, where a piece of it hit him (5512–5520).

Occasionally we still have cases where engines move in the wrong direction in roundhouses and run through the roundhouse walls into turntables. In the case of a power reverse gear where the air moved the wrong way, if he got his pressure and tried his gear, and got down and looked at it, it would be an oversight. We require our hostlars or anybody else going on an engine to know whether the gear is in good operating order or not before he gives it any steam. They are also supposed to test the air. I have known of engines equipped with the hand reverse gear going into the turntable pit and also of engines equipped with power reverse gear doing the same thing because some fellow misjudged his distance or had a slippery rail.

I see most of the reports made to the Bureau of Statistics on the matter of accidents with reversing mechanism on our road. In my opinion, we would have fewer with manual than with the power reverse.

(Question. Do you know that in the last two years on the Chicago and North Western and the Omaha, that there have been 15 reports of accidents, of which one was a power reverse and 14 were manual reverse?—Objected to by counsel for defendants on the ground that it is not proper cross-examination—objection overruled.)

WITNESS (continuing). I don't know anything about the Omaha's reports. I don't see them. I did not know that there were ten reports from the Chicago and North Western with manual reverse to one with power reverse in the last two years. I only know of one in the last year. I remember one last year because it was a chairman of the organization who violated instructions and became injured on a power reverse gear. I do not know anything about the year before. My statement that we have fewer accidents with
1565 hand reverse than with power reverse is my opinion. I have not checked the reports. I would not recall all of them if I did check them. However, I believe if you check those reports you will find that the nature of the accidents was much more severe with the power reverse than with the hand reverse.

(At this point counsel for defendants states that he is objecting to all questions with respect to what the Bureau of Statistics reports show regarding the accidents because he did not go into that on direct examination. Examiner points out that witness went into the question of relative safety and expresses opinion that it is proper that witness be confronted with these reports.)

WITNESS (continuing). In my experience I do not recall ever having had difficulty with the manual lever. I have heard of firemen helping the engineer with a manual reverse bar. I have seen firemen stand over beside the engineer and hook them up lots of times. The engineer would tell him to hook it up. I have done it myself as a convenience and not because I had to do it. In my experience it was never necessary for a fireman to do it, but I have heard that it was in the testimony here. There might be a little difference with respect to ease or difficulty of operation of the manual lever if there was a lot of snow and ice on the valve-motion parts. It would not interfere with the operation in any way if they are properly taken care of (5520–5525).

1566 I do not recall having seen report filed by the Chicago & Northwestern under date of January 7, 1929, in the case of Fireman G. C. McDaniel, who strained his back helping engineman reverse engine on which the lever threw very hard on account of extreme cold weather and frost on valve gear parts. I have had the experience of extreme cold weather and frost interfering, and I have poured a little kerosene on them and thawed them out to keep me going. I do not recall having seen report of accident in January 1929, which occurred under similar circumstances to Fireman Joseph W. Horn.

(Motion by counsel for defendants to strike questions and answers concerning above accidents, on the grounds of improper cross-examination and irrelevancy—denied.)

I have fired and run engines on the North Western. I have had them stuck in the snow. As a fireman I have helped dig them out, but I do not recall helping the engineer to reverse the engine, nor do I recall as engineer of having the fireman help me reverse the engine. If I had an engine stuck in the snow I would get down and clean out the links before I tried to reverse her. I would not try to reverse her full of snow and ice.

The 251 consolidation-type locomotives, known as class Z, as to which I previously testified, were not new engines. They came with manual gear and we replaced that with power gear. I cannot give the date of replacement, somewhere along in 1923 or 1924. It was made in order to get those engines in switching service. Most of them are in switching and transfer or light branch-run service at the present time. There wasn't very much difference between the use of the lever in road service and in switching or transfer service, but when we first purchased those engines some superintendent put one into switching service, and at that time we thought we had the best

engines in the world. There was a protest made and the gen-
1567 eral manager made the statement that they would not be used in switching service. The basis of the protest was that they were too big to put into switching service. We had to make an agreement that they would not be used in switching service. I don't think that the basis of the agreement was because they had the manual reverse lever, but when we wanted to put them into switching service the organizations raised that question and we put on the power reverse gears and took the coping off the tanks on engines of that class assigned to switching service.

The 41 class E Pacific type passenger locomotives which we equipped with Barco and Alco power reverse gears were not new engines. They originally had manual reverse. I can not give the date when we equipped these engines, but it was at the request of the organization, some agreement that we would equip so many engines with power reverse gear. It was a kind of labor-saving device, they figured it. I don't know in what way it was labor saving; that is what they made their argument on. The Young valve gear engines are a little heavier to handle than the other valve gears. These were all Young, so they claimed. I can not see very much difference. And the management agreed to give them something, and that was the something that was given to the organizations—equipping those engines with power reverse gears. This was done after 11 years of experience with the difficulties and troubles of the power reverse. The manufacturers are still working on the power reverse to make changes to correct it, and they started as far back as 1923. It cost $490 to equip a locomotive; that is according to the estimate that the mechanical engineer put up after having checked the cost of applying them on other locomotives. It cost about $147,000 to equip these 292 engines. We spent that much money simply upon the request of the engineers' organization, but we saved lots of money, too, by getting those engines into service where we could eliminate
1568 jobs—at least, the class Z territory. In the ore territory at Escanaba those engines were assigned to the dock service and we eliminated jobs there. I can not tell you now just how many, but it was a sufficient number to warrant it—there and at other places. The number of the class Z engines put into switching service varies from day to day. I could not say whether or not there would be 150 at one time (5525–5532).

In order to accomplish the purpose of putting these engines into switching service it was necessary to equip all of them at a cost of $500, because they are placed in switching service at different points on the system. After they were equipped with power reverse they were also used in road service and they are today, some of them. We do not ordinarily spend $150,000 just to satisfy some whim of the men, but this was more than a whim when you save purchasing locomotives by using the present locomotives in yard service. It is in practically all of the yards in Chicago, except the J–4's that we

purchased. They are practically all equipped with class Z locomotives except a few of the industry yards. I don't think these engines had to be equipped with power reverse gear in order to properly use them in switching service, except to get the agreement where we could use them. But even if the Chicago & Northwestern felt that the engines could properly be worked in switching service with the hand gear it would not put them into switching service if it had an agreement with the men not to do so—which it had. Such an agreement with us goes on until it is changed. This was agreed upon, I don't know why. I am not in on all of the conferences. There might have been other trades, too—give them all of this rather than something else. That is oftentimes the case on committee work. The men were insisting that these engines have power reverse gears on them if we put them into switching service. The men claimed that power reverse would make it easier for them. I don't know whether the man-
1569 agement agreed with that or not. The real determining factor in putting the power reverse on the class Z engines was that we could eliminate jobs and thus effect a proper economy. I think the men saw it and they took this method of getting the power reverse gears—a trade. That was the real controlling factor.

The consideration of saving assignments in the yard was the reason for equipping 41 class E Pacific type passenger engines. They gave them that concession at the time of a conference. That was one of the concessions. They asked for more, and when they got through with the trade that is what they got out of it, so far as the power reverse gears are concerned. Since this hearing I think they have asked for power reverse gears on every engine we have. Prior to this case, as I recall, they had not asked for anything other than the Z and the E.

We started to give consideration to the matter of providing proper clearance around the levers shortly after the clearance rules came out in the instructions of the Bureau of Locomotive Inspection. Since that time we have had some men caught with their feet on the quadrant. We have had men injured by the manual reverse but I don't just recall the real causes. I don't think a man can get his foot or leg injured on a manual reverse gear except through his own carelessness.

I don't recall the accident of August 28, 1923, on engine no. 70 when the left valve caught an obstruction in the port of the valve chamber and caused the lever to fly out of the quadrant and strike the engineer. I don't recall the case of July 21, 1928, at Beaver, Iowa, on engine no. 1571, when the main rod strap broke, knocking the cylinder head out, which caused the lever to unlatch and go to back position, injuring the engineer. I only recall one case, a man by the name of Molliter, on the Ashland division. I recall his having been injured by sitting with his leg in front of the reverse
1570 lever. I don't know whether it was a reportable injury or not. It seems to me it was not, although I would not say. But I

know Mr. Molliter personally, and the reason I know so much about it is because they wanted to apply pretty severe discipline and we did not agree with it. We changed their ideas. I don't know what trouble Mr. Molliter was having, but I know we had instructions out not to carry the leg in front of the reverse lever, and he carried his leg there. That was the point at issue when I got into the case. If he was having trouble with dry valves, that was all the more reason why he should have his legs away from there. I had such instructions out. My reason for putting them out was riding with a man with his leg on the reverse lever and in so doing he might work his latch out. That was his method of sitting. If anything happened, if a rod broke or anything, and if the lever got away it would catch him. There was no reason for carrying his leg there. His leg would work the latch up by being against the part of the latch that connects to the dog. If the latch was working at all it might work it up enough to release the lever. I know of no such case but it might be possible. In Mr. Molliter's case he was in the act of giving the valves more oil and had eased off on the throttle and was letting down the lever so as to give the valves more travel when he was pulled off his seat. The pressure of the pull broke the bones in his feet but if he had kept his feet away from in front of the lever as instructed to do he would not have become injured. I do not recall where he had his foot when it was broken, but I know he violated the instructions.

(Objection by counsel for defendants with respect to witness testifying as to information that came to him through talking with Mr. Molliter, overruled on the ground that witness in his direct testimony placed himself in a wide-open position on the question of accidents with the hand gear and power gear.)

WITNESS (continuing). I did not talk to Mr. Molliter. I
1571 talked with the master mechanic, and the verbal statement that I got from the master mechanic was that his foot was in front of the reverse lever. They wanted to dismiss him from the service (5532–5539).

We have had instructions put out for the men to keep their feet away from the lever. It is on the safety campaign to take every action possible to avoid a man being injured, to keep his feet from in front of the lever or his body from in front of the lever, if there is any danger of it flying out, because there is no necessity for either being there. I do not say that it is dangerous to have your foot or any part of your body in the path of the lever but I say that it is not necessary. We are trying to avoid accidents. I do not recall the happening on engine no. 1085 on January 6, 1929, at Gladstone Park, Ill., in which Engineer Gannon was injured when the reverse lever on a manually reversed engine unlatched and went to the corner catching his foot. I do not recall the accident which happened on July 2, 1927, on engine no. 1067 at Land-O-Lakes, Wis., where the quadrant and the brackets were loose, allowing the

lever to jump out of the quadrant and crush the foot of one of the enginemen between the lever and the boiler head. I would not recall any of those without having the files.

(Witness excused) (5539–5541.)

H. L. LEMHKUHLE, general accountant for the New York, Chicago & St. Louis Railroad, testified:

I was first employed by this railroad in March 1904. I was station accountant up to 1907; from 1907 to 1921 in various accounting capacities, and in 1921 I was appointed general accountant. I hold that position today. I have charge of the general books, the preparation of all financial statements and reports to the various governmental bodies. I have prepared statements with reference

1572 to revenue freight and income for use in this proceeding. The statement entitled "Nickel Plate Road. New York, Chicago & St. Louis Railroad Company. Income Statement" was prepared under my direction. It shows the operations of this company, that is, a comparison of August 1930 with August 1931 and eight months ended August 1931 compared with August 1930.

(Counsel for complainants object to above statement being received in evidence on the ground that the information is immaterial and of no value in determining the issues presented in this case. Counsel for defendants contend that the decrease in net income for the eight months of 1931 as compared with the eight months of 1930 is quite relevant.)

Above statement received in evidence and marked "Defendants' Exhibit No. 69."

WITNESS (continuing). Another statement headed "Nickel Plate Railroad. New York, Chicago & St. Louis Railroad Company. Statistics of freight and passenger operation", was prepared under my direction. This statement contains, on the left-hand side, the various classes of commodities hauled over the New York, Chicago & St. Louis Railroad for the month of July 1931 as compared with the same period of 1930. On the right-hand side it shows seven months ended July 31, 1931, as compared with the same period of 1930. It also shows the tons of revenue freight carried, the total freight revenue received from the tons of freight carried, the revenue per ton per mile, the total number of passengers carried, the passenger revenue received from carrying such passengers, and the average revenue per passenger per train per mile. It also shows the car mileage both freight and passenger. The red figures on this statement indicate the decrease by comparison, while the black figures designate the increase. The same is true on exhibit no. 69. The first figure in the column is 7343 in red, and the first figure in the next column is 47,004. This last number is the number of tons of weight handled in the month of July 1931. The comparison

1573 column shows the increase or decrease; the first column or the basic figure there is the total number of tons carried. In

the first column if it is a red figure it means a decrease and if it is a black figure it means an increase.

(Counsel for complainants object to introduction of this data as being immaterial.)

Statement received in evidence as defendants' exhibit no. 70.

WITNESS (continuing). My statement to the effect that all red figures represent a decrease and all black figures represent an increase is not correct with respect to exhibit no. 69, which is the income statement. In the first and second columns under the item "Transportation for investment credit" the red figures denote a reduction in operating expenses and the red income denotes a deficit from operations in that month. The same explanation is true as to columns 4, 5, and 6.

Another statement entitled "New York, Chicago & St. Louis Railroad Company. Income statement for the years 1923 to 1930, inclusive, and for the seven months of 1931 compared with same period of 1930" was prepared under my direction. This statement shows the net result of the company for the period 1923 to 1930, inclusive, and for the seven months ended July 31, 1930, compared with the seven months ended July 31, 1931. It also shows the percent of increase or decrease of each succeeding year following 1923 over the year 1923, showing the net railway operating income as reported to the Interstate Commerce Commission, and also the net income. Under the heading "Operating expenses" "Transportation for investment credit" the red figures under the columns "Years" denote a reduction in operating expenses due to the classification of operating accounts whereby a carrier is entitled to receive so much. Under the various columns entitled "Percent of Increase" or "Percent of Decrease" over 1923, the red figures
1574 indicate the percent of the decrease while the black figures represent the percent of increase. Page 2 shows that there is a net decrease of 82.33 percent for the first seven months of 1931 as compared with the first seven months of 1923.

(Counsel for complainants object to receipt in evidence of foregoing described statement as being immaterial, particularly the computations of the witness as to variations from the year 1923.)

Question by examiner: "Why did you just go back to 1923?"

WITNESS (continuing). 1923 was the first year of the present Nickel Plate Railroad, or the present New York, Chicago & St. Louis Railroad. That was the date of the consolidation. Prior to that time it was not the reorganized company.

(Statement previously described received in evidence and marked "Defendant's Exhibit No. 71") (5541–5550).

Another statement entitled "New York, Chicago & St. Louis Railroad Company. Statement showing revenue traffic by years for the period January 1, 1923, to December 31, 1930; also for the seven months ending July 31, 1931, compared with the same period of 1930", was prepared under my direction. The statement shows the

average miles of road operated both in freight and passenger service; the number of revenue tons carried, the freight revenue, the number of revenue passengers carried, the passenger revenue, passenger train miles, passenger car miles, and various averages pertaining to same. The red figures denote the percent of decrease while the black figures denote the percent of increase over 1923. Item no. 4 on page 2 of this statement shows that the number of revenue tons carried one mile decreased 31.17 percent in the first seven months of 1931 as compared with the first seven months of 1923.

(Above described statement received in evidence as defendants' exhibit no. 72.)

1575 CROSS-EXAMINATION

Exhibit no. 71 shows the gross income for 1923 to have been $10,000,000 plus. Interest on funded debt represents our interest on our mortgage bonds and equipment obligations. That interest is on the total indebtedness of the road. The item, other deductions, $193,000, represents partly items such as rent for leased roads under the I.C.C. classification and miscellaneous tax accruals, miscellaneous rents and miscellaneous income charges, of accounts designated by the Interstate Commerce Commission. In that year the net income was something over $6,000,000.

(In answer to question as to how the net income compares with the capital investment of the road or the capital stock of the road, witness answers.)

In 1923 the New York, Chicago & St. Louis Railroad paid dividends to stockholders on preferred and common at the rate of 6 percent. I do not have the figures with me as to what balance remained after these payments, but I can furnish them within 10 days. There has been no change in the capital structure from 1923 to date.

Upon request of counsel for complainants, witness agrees to furnish information in 10 days as to what dividends were paid on the preferred and common stock and what balance remained each year for the period covered by exhibit no. 71.

(Witness excused) (5551–5555).

1576 JOHN NYE, employed as a machinist by the Denver & Rio Grande Railroad Company at Salt Lake City, Utah, testified:

I have been employed by the Denver & Rio Grande as machinist at the Salt Lake roundhouse for about 8½ years. During the entire period I have been engaged in work on air brakes. I do repair work on air brakes and on power reverse gears. I would say that there are between 50 and 55 engines equipped with power reverse gears serviced in that roundhouse (daily). It would be difficult to say how many of those engines I get in one shift on duty. Some days you have a good run and some days you do not. Perhaps

today you would have 8 and 10 of them and tomorrow perhaps you would have 4 or perhaps 2. My work on these power reverse gears is just general repair work, whatever is reported by the engineer and whatever the inspector finds. I see the work reports and know when the gear is reported creeping and when it is not. I do not know how often I have had occasion to make repairs because of the gears being reported as creeping. I have not kept any record nor made any check before coming here. It is rather difficult to give a daily estimate of them. I have had occasion to work on more than one of those gears for creeping in a single day, perhaps 2 or 3. The work I have done when they were reported creeping consists of renewal of packing leathers, grinding in reverse valve, packing the piston. The parts to which I have referred are all parts of the power reverse-gear mechanism. Once in a while I just have to tighten up on the packing without renewing it, but very seldom. I generally repack them.

There is a steam connection to the power reverse gear on the engine that are serviced in the roundhouse at Salt Lake. With respect to renewals of packing we have had a great many of them burned out with steam by men turning on that emergency
1577 valve. They will get up there and perhaps turn the lubricator on, get hold of the wrong valve, but there is a tag on it designating the emergency valve to the reverse gear. After the steam has been turned in its burns the packing leather plumb out. We have not had so much of that lately. About a year we had a good deal of trouble with it and we made a campaign to stop it. We have some of them do it yet. I had occasion to renew the packing about three weeks ago. As to how it happened the only thing I know is that we have an inspector there to inspect these engines before they got out. He came to me and said: "John, you had better get to the reverse cylinder. Somebody turned the steam in." So I put in new packing. I always put in new packing when steam has been turned into the gear. Engineers on our railroad have instructions to report when they have used steam on the road and they have to report it when they come in off a trip. The purpose of that is they figure that the packing leather would be burned out and the repair man is supposed to fix it (5556–5563).

These packing leathers are put out by the Johns-Mansville people. They are sometimes called a packing cup and the reverse gear piston works back and forth just inside the packing leather. The reverse piston works through the front head. The packing leather goes in the follower head back on the rear end. The purpose of it is to keep the air pressure from leaking out of the cylinders. In the ordinary use of the gear in ordinary service these packing leathers should be renewed in from 4 to 6 months. It takes about an hour to renew one of these packing leathers. To do this I have to take the back head off the cylinder and get it in full back motion. I have noticed the

valve gear on a locomotive equipped with power reverse move when the locomotive was standing in or around the roundhouse
1578 when no one was in the cab at the time. Take an engine after the air comes off of it and you have no air in the cylinders to hold your valve motion, and if you haven't got extra tight valve motion she is going to drop down out of lap position. When she drops down in lap position she automatically carries the rotary valve off the seat. Then when you recharge your engine back up again that valve, being off of its seat and the air coming into connection with the front of the piston or the rear of the piston, whichever way the valve is sitting, will cause a movement there until this valve gets on center. I am speaking of the rotary valve of the reverse gear.

I have been injured while at work repairing these power reverse gears. It occurred on August 15, 1928, at the Salt Lake roundhouse. I was renewing packing leathers in the reverse cylinder of that engine and I had put the packing leathers on the follow head and tightened up the nut and put in my expander rings, and I got my iron bar to pull in the packing leather with the iron bar over the radius rod. This one went in a little extra tight, for no reason that I know of unless it might have been that my expanding ring got fouled. It was the packing leather that went in tight. Then when she got away the bar slipped and threw me on the ground and wrenched my left knee. I lost 7 days. When I said "she got away" I meant when the packing leather automatically went into the cylinder out of the counter bore. That permitted the piston of the power reverse to move with it; it had to. My purpose in using the bar there on the radius rod was to get the piston in so I could lubricate the rear end of the cylinder. I never pushed it in by hand. It is too tight for that and not only that, but you cannot get any hold of the back end. There was no air or fire in the engine. She was dead. Both of the valves which let the air into and out of the power reverse were open. The engine was dead, no steam or air on her.

1579 Locomotives equipped with hand reverse levers, the so-called Johnson bar, are serviced in the Salt Lake roundhouse. I don't have anything to do with them whatever, nor have I had any experience with them in the past (5563-5569).

CROSS-EXAMINATION

My specialty is maintaining air brakes and power reverse. I have renewed the packing in a brake cylinder. The difference between putting in a brake cylinder packing and a packing in the air reverse cylinder is with a brake cylinder you have only the one leather; on the reverse cylinder you have two. On that brake cylinder you can put the packing in from the front of the cylinder as well as the rear. whereas on the reverse cylinder you have to put them both from the rear. In putting packing in a brake cylinder you have to put that in the follow head and pull that into the

brake cylinder, that is, if you put it in from the rear. You don't have to pull it in or knock it in.

(Further questioning with respect to brake cylinders opposed by examiner as not being of interest in this proceeding.)

WITNESS (continuing). I have used this same method of getting the packing leather in, that is, using a bar in connection with the radius rod on previous occasions when I was putting in these packings. I use it at the present day. I find it necessary to do that in order to forte the packing in. If you butt that packing in with a block it is mighty hard on your gear. I suppose it could be done. That would be all right if you had a helper but I had no helper at that time. I was alone. The cause of the packing going in extra hard on that occasion might have been that my expanding ring got fouled or the packing cup was a little extra large. There was no defect connected with the bar slipping. The bar just slipped off the brace.

1580 In making repairs I have had to grind in the reversing valve; that is necessary every time they are reported leaking. If the reversing valve is kept oiled and not too much water gets into the cylinder, I figure one ought to last about eight months.

REDIRECT EXAMINATION

What happened me to fall was when that leather got in, in against that lubrication on the inside of the cylinder, then the (she) set hard, and when she got lubricated, of course, she worked nice after she got into the cylinder, and when she jumped that is when I was thrown down. The bar did not slip because of not being properly placed. When the packing did what I wanted it to do, that is, when it went in that is when I fell.

By creeping I figure a reverse gear does not stand properly where it is placed, that is what I understand to be creeping on the reports that I see. What we figure creeping is, is where the engine does not stay properly where it is placed. If it makes a movement it is creeping. Whatever movement it makes is creeping where it will not stay stationary (5569–5574).

(Witness excused)

1581 W. J. CRABBS, employed as mechanical engineer by the Western Maryland Railroad, and living at Hagerstown, Md., testified:

I have been with the Western Maryland nearly 30 years, and have been a mechanical engineer for them about 15 years. I began as a machinist's apprentice and served my time at the trade. Later I went into the drawing room and worked there until I was finally promoted to mechanical engineer. I went into the drawing room about the time I came out on my trade. I am familiar with the different classes of locomotives now in service on the Western Maryland; with their various wheel arrangements; dimensions and weights on drivers, etc. Power reverse gears first came into use on

Western Maryland locomotives with the purchase of our first Mallet type in 1909, and since then all new power has been either of the Mallet type or much heavier than older equipment of other types, but the use of power reverse gears was restricted to Mallets until the increased size of locomotives with wide fireboxes made power-reverse gear a necessary feature of the design, to keep within clearance limits. This increasing size of Western Maryland locomotives with correspondingly larger fire boxes is shown by the following list of successive orders.

Date	No. locos.	Type	Size firebox, length × width	Weight-pounds on drivers	Total	Reverse
1909	10	2-8-0	108 × 70	182,000	200,000	Hand.
1909	5	4-6-2	102½ × 66	128,500	201,700	"
1909	2	2-6-6-2	117 × 96	298,100	342,000	Power.
1909	3	0-6-0	108½ × 42⅜	142,300	142,300	Hand.
1910	6	2-8-0	111 × 70	206,000	232,000	"
1910	2	2-6-6-2	117 × 96	310,000	354,000	Power.
1911	5	4-6-2	102½ × 66	128,500	201,700	Hand.
1911	5	2-6-6-2	117 × 96	310,000	354,000	Power.
1911	30	2-8-0	111 × 80¼	215,000	241,000	Hand.
1912	9	4-6-2	111 × 80¾	160,500	254,300	"
1912	15	2-8-0	111 × 80¼	216,000	243,000	"
1914	5	0-6-0	72⅛ × 65¼	164,700	164,700	"
[1582] 1914	20	2-8-0	110 × 80¼	217,500	244,500	Hand.
1915	10	2-8-8-2	150 × 96¼	435,000	497,000	Power.
1916	5	2-8-8-2	219½ × 89⅛	435,000	497,000	"
1918	10	2-8-8-2	219½ × 89⅛	450,000	298,500	"
1919	10	2-10-0	108 × 86¼	195,200	210,000	"
1921	40	2-8-0	112 × 96¼	287,910	309,910	"
1923	10	2-8-0	112 × 96¼	287,910	209,910	"
1927	20	2-10-0	132 × 114	386,800	419,280	"

During the past few years we have endeavored to keep these locomotives in what we call modern or up-to-date fittings for service, and to accomplish that the main things that we have done were to apply super-heaters and arch brick. The only engines on which we have applied power reverse gears were 10 Russian engines and 3 old consolidation engines. The Russian engines did not have hand reverse. They had a hand screw reverse on them that for some reason, I don't know exactly why, were not satisfactory and they were replaced with power reverse gear. Then about 11 of our old consolidation engines were converted to switchers and 3 of those had power reverse gears applied. I do not know any sound reason for applying the power reverse gears to those three switchers other than that we had them on hand and somebody wanted to put them on. They were removed, I think, from the Mallets shown on the preceding list and had been replaced by Barcos. It was not I who decided to put them on the switchers, it was either the superintendent of motive power or someone of the shop force. I don't know who raised the question. Except as I have just mentioned, my road has not found it either necessary or desirable in the carrying out of the policy to keep the locomotives modern and up-to-date to apply any power reverse gears to any of them. The only hand reverse that has been changed to power

1583 were those 13 or 14 engines that I mentioned. Of course, the Russian engines were a foreign built engine and we don't have anything to do with their original construction.

With respect to what benefit is derived from the power reverse gear on locomotives we have bought equipped with it, our first to other orders for Mallet engines and we followed that by applying to other orders for Mallet engines. Aside from that, its adaptability to our last design made it desirable. In fact, I do not know of any hand reverse that could be applied to our later engines on account of their extreme width. You will note by the list up to about 90 inches we used hand reverse, and after that we have a maximum there outside of cab, I think, of 11 feet. When you get beyond the 90 inches it does not allow much space between the fire box and the inside of the cab to apply such a contrivance as a hand reverse lever. All of our Mallets have the power reverse gear. They are a double set of valve gear to be reversed, and to pass the articulating point on the engine—I never saw one with a hand reverse on it and I don't know how it could be arranged. I would not say that it could not be done, but, at the same time, I have never seen it done.

(At this point counsel for complainants objected to witness testifying as to what claims manufacturers of power reverse gears have made as to their desirability from the standpoint of economy or otherwise. Objection sustained.)

WITNESS (continuing). I have had contact from time to time with the representatives of the manufacturers of power reverse gears who were seeking to induce the Western Maryland to purchase such gears.

1584 (At this point counsel for complainants objected to witness testifying as to what arguments or reasons manufacturers' representatives put up to induce the purchase of gears, on the ground of hearsay. Examiner states that if the views of the manufacturers are going to be implied the manufacturers should be present to testify, to point out that witness can state why he put the gears on if he had anything to do with putting them on) (5574–5583).

(Witness continuing, answering question as to whether or not he was the party who determined whether the gears should be put on.)

On the orders for new locomotives I will not say that I made the specifications, but with the superintendent of motive power and others I had a hand in making the specifications for them, and in that way probably was responsible for the gears being on in some cases, at least. My reason for specifying them on the last three orders for new locomotives was that they were all of a construction that would not admit of a hand reverse gear.

I do not think that economy of operation governs the application of power reverse gears on any of these locomotives. We had the idea, of course, that they were an improvement over hand gear, but that alone was not the reason for putting them on. I do not oper-

ate the engine, but from the general information I have these gears creep and thereby cause a loss of fuel and difficulty in operating the engine.

(Counsel for complainant moves to strike out answer based upon witness' general information.)

I get my information about creeping and loss of fuel from road foremen and other enginemen and shopmen I talked to about
1585 that. Of course, the shopmen were not as well informed on that as the engine crews. The information is obtained from road foremen of engines and enginemen I talked to from time to time. Of course, I have to keep in touch with those things and that is the source of my information. I have practically daily contact with the shopmen and engine crews. Of course, we don't talk every day about reverse gears, but anything that is going on on the railroad, I am supposed to be informed about, particularly as to something that is causing trouble. My office is near the shops. I have contact with or superintendence over the work that is being carried on in the shops so far as changes of all kinds are concerned. Based upon this general information and contact, I don't know of any economies that have resulted from the application of the power reverse gears on the Western Maryland.

(Counsel for complainants object to above statement—based upon information other than personal experience. Objection overruled.)

(Question as to whether any economy has been effected in the saving of fuel by putting on the power reverse gears, objected to by counsel for complainants on the ground that witness is not qualified. Objection sustained as shown to be qualified.)

WITNESS (continuing). The main line of the Western Maryland is about 400 miles long. I think the railroad has 252 locomotives, 34 of which are Mallets. The headquarters of the mechanical department is at Hagerstown. The operating headquarters of the road is at Baltimore. There are two divisions on the road. Cumberland is the dividing line. I have not ridden engines very much in the last few years. I have ridden a number of times when there was some difficulty or something to be investigated or tested. If an
engine I was riding on had creeping gear I did not know
1586 it. I was not investigating the reverse gear. I don't imagine I have ridden locomotives on the Western Maryland more than 2 or 3 times in the last five years.

The types of power reverse gear which we have on our locomotives are the Alco, Barco, Ragonnet, and Pittsburgh. We have only two Pittsburgh and two Alco. The action of the Pittsburgh is very similar to the other except that it has a clamping device that is supposed to hold the piston in a fixed position after it is once shoved to the desirable place. The clamp is operated automatically, as nearly as I can explain, when the piston went to its proper location. So far as I know, the company that made these went out of business, I think prior to 1923. These gears were placed on the second and

third order of Mallets. I don't know what the year was. We also got them on the order of consolidations in 1922. There were 40 of them. Whenever there is trouble with reverse gears or any other appliances it is reported to me. I keep familiar with such matters at all times on my road. The trouble which is reported to me relates to matters that cannot be corrected by repairs, anything that involves a change in design. We have made changes in power reverse gears on our equipment by substituting the Barco for a large number of the Pittsburgh, and I suppose we have substituted Barcos for a few Ragonnets (5583–5590).

I get information with respect to creeping in the same manner—as to anything that is causing trouble it is my duty to investigate so far as I can and familiarize myself with the different contrivances on the locomotive and inform myself as to how they perform, and along that line it comes to me pretty directly when anything
1587 of this kind occurs. I have not made any investigation as to creeping by going out personally and riding on the locomotives to observe it, but I have made investigations by consulting the road foremen or assistant road foremen or a special man we have who is air-brake inspector and looks after matters of that kind. There are a number of men who follow that up on the road and they report to the office what they find. I got such information about creeping long before I ever heard of this case. These reports came to the superintendent of motive power's office and I am part of it.

(Question as to what extent witness has experienced creeping on his road from the knowledge gained from the men who reported to him and with what type of gears, objected to by counsel for complainants. Overruled.)

WITNESS (continuing). The same information comes to me on all of the types that they ever had; that these all creep. Furthermore, my efforts to learn which creeps the least has not revealed much difference, if any. I have tried to determine which creeps the least and my purpose in so doing was, as shown by the application of the Barco gears, to find a gear that would not creep so much as the others did. That was the thing that originally recommended the Pittsburgh gear. It was a guaranteed gear almost, you might say. And that is one gear as to which I cannot say whether it creeps as much as the rest. But we took it off because the company went out of business and we could not buy repairs for it. We put on the Barco because it creeped the least. That was done between 1923 and 1927.

(Question as to whether or not these gears creep objected to by counsel for complainants on the ground that witness has never made any personal examination. Overruled.)

1588 WITNESS (continuing, in answer to above question). They also creep. Not long after we had them they were creeping and the representative of the company came there, and we conferred in the superintendent of motive power's office on the subject with him,

and he agreed that his valve did not have sufficient lap. That was the one experiment, at least, that was made. After being on the road sometime and trying different ideas to correct the creeping the matter was more or less dropped. Possibly the gears were not as bad as they were. But they still performed in a similar way. I couldn't say as to what percentage of the trips they would creep.

(Question as to whether or not the reverse gear manufacturers have been making any efforts to overcome the creeping, objected to by counsel for complainants on the ground that witness does not know what the manufacturers are doing. Overruled.)

WITNESS (continuing). I do not know whether the manufacturers have been attempting to overcome the creeping. Although I believe they have, I cannot say that I know it. The Western Maryland has been making efforts to overcome this creeping. Their efforts have been to maintain the gears as well as possible and, as I said before, their efforts have been to obtain a gear they have confidence would not creep. They have been seeking improvements. We followed out the suggestions of the representative of the manufacturer who was on our line. We have endeavored to maintain them in first-class condition in order to check the creeping and have made such repairs on them from time to time as appeared to be required (5590–5597).

1589 I am familiar with the hand lever or Johnson power type of gear in use on the Western Maryland, and I am familiar with the locomotives so equipped. I have not made any check of the accidents which we have had with hand reverse gears and power reverse gears. We have had accidents on the Western Maryland due to loss of control by hand reverse gears. I have not been present at any time when these accidents occurred, and cannot give details except from reports. I also know we have had accidents due to loss of control of locomotives equipped with power reverse gears. I was not present when the accident happened but our office is located within view of the turntable. I saw the engine in the pit. Of course, I did not run her in there. I know it was reported to be there because of pressure in the reverse cylinder. All I know is that I saw the engine in the pit. The accident happened between night and morning, and I went to the office in the morning about 8:00 o'clock and it was there.

(Question as to whether witness had any opinion from the standpoint of safety of operation as between the Johnson power type of reverse gear and the power reverse gear in case of emergency where quick action is needed to reverse the engine, objected to by counsel for complainants on the grounds that witness is not an engineer and has not shown basis for forming such an opinion. Overruled.)

WITNESS (continuing, answering above question). My opinion is that the hand power is a more reliable device and admits of more, perhaps, in meeting an emergency which is not met by power reverse. My reason for the opinion is this, that the bar can be swung to back

motion—an engine caught on sand—to make an emergency stop. In my opinion the fact that the power reverse is dependent upon the presence of air pressure for its operation enters into the situa-
1590 tion from a safety standpoint. It is quicker and there is no danger of the air or steam being disconnected; it is positive and quicker in its action. I do not know whether you can safely reverse an engine with the hand gear while she is running at high speed. I am not an operator. As to any difference from the safety standpoint with respect to engines standing in the roundhouse with the fire drawn and then being fired up afterwards, one equipped with the hand reverse and the other equipped with power reverse gear, with the power reverse gear it is possible that steam will develop from water lying in tubs (the tubes) or from any source of leak, and it will start the engine sometimes before the air pumps are on, and for that reason it is very important to have the lever set in the center when you draw the fire. We have had movements in roundhouses from that source or cause. These engines were equipped with power reverse gears. If we had anything of that kind with hand reverse the lever could be pulled to the center quickly without waiting for the pressure. We have not had any such cases with the hand gear that I know of, and I think I would know of it. In my opinion, the application of power reverse gears to locomotives of the Western Maryland, which are now equipped with hand reverse gears, would not contribute anything in the way of added safety in operation. I suppose the fact that we have power gears on quite a number of locomotives adds something to the lack of safety in operation. Any power contrivance has a certain hazard to it. You might say a powerful machine is there for a certain purpose, and it may be a very necessary purpose but at the same time it is hazardous.

I have estimated the cost which would be involved to replace the hand reverse gears on the Western Maryland with power reverse gears. For the different classes might estimate runs about $500 to $550, and the total for the road about $75,000.
1591 These estimates are based upon previous experience in applying such gears. The type of gear planned on is the Barco and the engines to which we would have to apply this gear—a considerable change would be involved in our reservoir arrangement which runs the price up a little bit, and I do not suppose there would be any that it would not be involved on (5597–5604).

CROSS-EXAMINATION

I have never made any test trips on locomotives with respect to the operation of the power reverse. I have made an effort to find out which of the power reverse gears crept the least but in making this effort I have not made any systematic check of work reports nor have I ridden the engines. I have had parts of the gears brought into the office but I cannot say that I went into the shop. I go to the

shop frequently but I couldn't say how often to check up on work being done to reverse gears. I have gone there for that specific purpose. I think about a year and a half or two years ago. We have one main shop at Hagerstown and also at Port Covington, and then we have a large roundhouse at Cumberland and smaller shops at some other locations. I am not familiar with what goes on in those shops from day to day with respect to work on power reverse. When I said the company made such repairs as appeared to be necessary I was not speaking out of any regular experience I had with the shops or the roundhouses as to whether necessary repairs are made. I had not inspected them for it. I know that those are the orders, they are directed to do it.

I cannot say that I know that there has been some improvement in the design of power reverse gears since they first same out. I know there are claims made for it. I don't know of any improvement that has been made. In a general way, I am familiar

with the quality of the packing that is now furnished
1592 as compared with what was furnished years ago. I don't know whether we are using a different packing. We are using a type of packing now that has been in service a long time. The first gears we had had packing cups on the pistons. With respect to the gears purchased from 1913 to 1922 the first 15 Mallets, I think, were equipped with the Ragonnet; the later 10, I think, were the Pittsburgh. In 1922 we changed from one type of Ragonnet to another type. We took the latest type. Not necessarily the latest type of Ragonnet, we bought some Barcos in there. We did not order the earlier type of Ragonnet after once getting the later type. We found there had been an improvement in the later type in the valve. So far as I am able to say, the most improvement was in the maintenance of the gear, because the valve was less likely to get out of order or leak. The original ones had the slide valve on them, but later we got the rotary valve. If there was an improvement in the maintenance it would reflect in the performance. With respect to the three Consolidation engines that we changed to switchers, the company considered that a suitable change; somebody did or they would not have been put on. I don't know the exact date but I think that they were put on within the last three years. I do not know whether the engineers' committee requested that change. We do not have any engineers' committee on our property now that I know of. I do not know of any request having been made to take the power gears off those Consolidation engines. I have not made any such recommendation.

REDIRECT EXAMINATION

Those converted engines, the consolidation, have been in
1593 service about 20 years with hand reverse on them, and I never heard of any complaint. We are operating larger and heavier

engines with hand reverse on them at the present time. I don't know of any reason why the hand reverse should have been taken off (5604–5610).

1594 JOHN MALONEY, 61 years old, employed as locomotive engineer by the Chicago and North Western Railway Company, and living at South Pekin, Ill., testified:

I was promoted from fireman to running an engine in 1905, and have been running as an engineer practically all of the time since with the exception of one or two years or one or two times when I was set back for a short period. As an engineer I have had experience in operating engines equipped with the so-called Johnson bar. In fact, that is all we ever had until 1912 or 1913. We have had air reverse from about 1913 up to the present time. We have had air-reverse equipment constantly from the time they adopted it about 1913. Prior to 1913, when engined were equipped with the Johnson bar I have run every power they have had on the Chicago and North Western from the 17-inch standard engine to the present engines we have, with the exception of the last engines they got, the H. We got the class Z engines on that division, I think in 1907 or 1908. They had what is called the Johnson bar reverse gear. We ran them with that kind of equipment until 1913 or 1914. During the period 1907 to 1913, we were assigned to regular engines and I was assigned engine 1457. That was my first regular engine, as a Z engine. That division was equipped with the Z engines with the exception of a few R–1 engines that they were using on way freight. In the service I was in the Z engines were assigned as regular. They were regular engines, and every man was assigned to his own engine. In operating engines equipped with hand reverse the handling of the reverse levers never caused me to over-exert myself nor did it ever have any bad effect upon me. In those days we worked on Z engines from 10 to 16 hours a day. In operating hand reverse levers I don't ever recall any experience of a lever becoming unlatched and going down to the corner, so called, to the end of
1595 the quadrant. I never had one pull away from me or get beyond control. I don't recall ever having had any delays with the Johnson bars due to failure of the lever. I was never injured in connection with the operation of the Johnson bar nor did I ever see anyone else injured.

With respect to my being injured in connection with the operation of the power reverse gear, I think it was about 1913 we got the first power-reverse, and I think there were 10 or 12 of those engines that came from the works and we were assigned to them. I just don't recall whether we were assigned to them when they came or when the business slacked up that season, but I know that we got them, and I had engine no. 2307. That was the engine I got hurt with. We were going north one day with a train of coal on a hill known as Radnor Hill, with a helper on the rear end, assisting us

up the hill. We came to a point on this hill known as bridge no. 1613. I went to drop her a little more. She was slowing down, and when I unlatched her, instead of going down she started kicking and she kicked me clear back against the cab. The fireman or the brakeman shut her off, but I still had hold of the lever and we stopped. I was pretty badly bruised up from it. We finally got her into the corner again and got the train started and proceeded to Radnor, but before I started I got down and examined her to see what was wrong and I couldn't find anything wrong. I don't know what kind of power reverse gear it was. I have forgotten. They came equipped from the locomotive works. I held on to the lever. Maybe I was foolish. I paid for it, anyway. The power reverse gear was operated by air. I have just forgotten the name of the gear. It was not the Ragonnet. I didn't turn loose of the lever, because I thought it was a good idea to hang on to it. I think I was off a little over a week. I was bruised and my shoulder and arm were sore for a week or so (5610–5617).

1596 With respect to observing anyone else receive an injury in connection with the operation of the power reverse gear, we got a lot of new engines known as the 2500's and I think they came to that division in 1922 or 1923. We had a very heavy business that winter and in the spring, when business let up, they assigned those engines regular to regular men, and I got the 2551. A fireman firing that engine by the name of Bob McMahn—we were going north one morning between 10 o'clock and noon, on Radnor Hill, and I put her down in the corner, and we were going into the hard pull and I kept her there until we got to the top of the hill. There is a water tank at the top of the hill at Radnor and we stopped and took water. When I went to get her out of the corner I couldn't get her out. Bob says to me "Is she stuck?" I said "I guess she is, get up and get water and I will get down and see what I can do with it." But instead of Bob doing what I told him to do he grabbed the shaker bar and went down and pried on her and she let go. She hurt Bob's arm. To what extent he was off I don't know, but I think it was about two weeks. I went to shut off the injector. His injector was working and I went to shut it off and get a monkey wrench, and before I got to it he had been down to her. I thought he was up taking water when this happened. I didn't see it, but when I got down there he was holding his arm. I asked him what was the matter and he said he got hurt from that shaker bar. I said: "How did you do that?" He said: "I pried her loose and she flew up and hit me in the arm." The bar was on the ground. He was standing alongside of the air reverse gear down on the ground. I didn't see it, but I got his word, and that is the statement I made out, based upon his word.

We had other occasions where the power reverse gear failed to function, that is, failed to reverse the engine. We had that with no. 2307. We took her into Nelson at the terminal one day and

there was nothing wrong with her going up, but when I was
1597 called that night to go out with her, she was in the round-
house and they couldn't get her out. She was on center and
we couldn't get her off center. We had to back her out of the round-
house at Nelson. At that point we took them out. At South Pekin
we did not. The hostler takes them out. I went and told the
roundhouse foreman about it. I said: "There is something wrong
with that engine. I can't get her to reverse." He said: "What was
the matter with her when she came in." I said: "I don't know.
She came in here all right. She must have. She is in the house.
But I can't get her out." I don't know what they did. They all
worked around there and it delayed the train on account of it. They
were going to fire up another engine. The train was delayed about
an hour, but we finally got her out of the roundhouse. The round-
house foreman and the machinist worked on her and I don't really
know what they did do. They didn't say and I didn't ask. I was
tickled to death to get her started and get home. It was their
funeral and not mine.

I ran engine no. 2811, a J–4 class engine, during the summer of 1929. It was equipped with the Barco reverse gear. I experienced delays with that engine in connection with the reverse gear operation. I was on train no. 11, one of the best time freight jobs they have on that division, and when we arrived at a place known as Kickapoo Junction, there are two lines there, and one goes to South Pekin and the other into Peoria yard, and we always have time freight for Peoria. We went in there with 10 or 12 cars. We went in with some and brought out some. I don't recall how many but when we got out we got all ready to go on the high line to South Pekin and we couldn't get away. The conductor, the head brakeman, the fireman, and myself were there, and the conductor said, "Hand down that shaker bar and I will loosen it." "No," I said, "you will not use any shaker bar on her at all. I had one shaker
bar case on my hands and I don't want another." So I backed
1598 her up. I thought if I would back her up and give her a jar
against the train she would let ago, but she did not. There
was a piece of rail about four feet long, and we picked it up and hit
the link a jar and she let go. I took her into South Pekin and re-
ported the condition of the engine. They went over her and said
they couldn't find anything wrong. That is all I know about that.
We were delayed at Kickapoo about 35 minutes. When I hit the
link and she let go she went from back to forward motion. I was
on the ground. I had her unlatched up there. When she let go she
went with a jerk (5617–5622).

I don't recall that I ever had any delays in my train operation on account of the failure of the Johnson bar to function. In my experience with the Johnson bar I never had any trouble in maintaining a desired point of cut-off. With power reverse gears we have experienced shimmying more or less all of the time with them. That does not apply to any particular time of power reverse gear. I think

we have only two kinds down there. One is a Barco—I guess we had a Ragonnet or two—and the Alco. The engines that I am operating have the Barco. By shimmying I mean an engine taking steam when she ought not to take it with the gear—the gear movement of the piston movement back and forth. If you have any leak at all in your air-brake cylinder you are sure of more or less creeping. You are going ahead and working them back and forth to get them back to where you can get the cut-off where you ought to work the engine properly on a ruling piece of grade or road. With respect to the effect on a locomotive when the gear is shimmying, an engine that is taking a mix that way and hadn't ought to be getting them, she is hard on the draft gear of your train; she is jerking your train. Anybody knows that that ever ran an engine. It has an effect upon the exhaust and it would have an effect upon fire and everything else in that if you were to have an engine at a short cut-off
1599 and you were dropping her down you would have an effect upon your fire and also upon your flues if you dropped her down. There are lots of times it earns a boilermaker for one of those engines; it requires a boilermaker to come in there and trim them up.

I don't know which is best qualified on air generally, the engineer or the conductor.

CROSS-EXAMINATION

In 1913 when engine no. 2307 kicked back with me it kicked me to the back wall of the cab. The power reverse hand operating lever was on the quadrant, the long reverse lever. It was one of those long bars just the same as the Johnson bar. It was the Melline gear. They do not have them any more. I have run passenger engines on our property. We haven't had the "E" type that has Young valve motion. We have the 600's. They are an 18-inch McQueen. I have never run the Young valve motion passenger engines. They are all up on the main line. I have been running power reverse since 1913 or 1914. I have had a good many successful trips. The fact of the matter is as long as a fellow does not get killed all trips are successful, almost. I do my work, everything that is asked of me, and live up to my schedule as near as I can. We try to keep on time as near as we can on freight. I would not say that we are 98 percent on time because we are always late. We are always making up time. We do not always get it made up. Sometimes we are so late we do not make it up, but we are making the running time and better. I do not know whether it would be advisable to change the schedules. We have got a run, and are carded out of Nelson at 4 o'clock, and it is usually about this when we leave there, so that I do not think there would be any necessity for changing that schedule. We are always late enough. We are usually late on that run not on account of the power reverse but on account of the trains on the other divisions not getting there, so far as I know.

(Witness excused.) (5625–5632.)

1600 G. A. MORIARITY, general mechanical superintendent, New York, New Haven & Hartford Railroad, with headquarters at New Haven, testified:

I have been in the employ of the New York, New Haven & Hartford since August 1907. I entered service as master mechanic on what was then the old Taunton division at Taunton, Mass. The early part of 1908 I was transferred to Providence, R.I., as master mechanic of the Providence and Worcester, later and at present the Providence division. I was in Providence until September 1913 at which time I was transferred to Boston as master mechanic of the Boston division, now the Boston and Midland division. I served as master mechanic there until January 1917 when I was made general master mechanic retaining that title until May 1917 when I was made district mechanical superintendent, covering the lines east, which included Providence, Midland and Old Colony divisions. In June 1925 I was made general mechanical superintendent, my headquarters being transferred to New Haven where they are at present. During that time as master mechanic my jurisdiction covered the mechanical equipment, mechanical matters, of the respective divisions, and I served in that capacity as a general master mechanic or district mechanical superintendent with jurisdiction over those divisions and in a general way making it necessary to keep in touch with the affairs of the mechanical department as pertaining to the several divisions under my jurisdiction. As general mechanical superintendent it is my responsibility to maintain the motive power and equipment with reference to keeping it in a safe and serviceable condition for operation, and in the matter of improvements my recommendations to the vice president and general manager in charge of operations, subject to his approval governed

1601 as to whether money can be made available for such work, in addition to the necessary appropriations for routine maintenance. As regards appurtenances and various appliances on our locomotives, their performance, which is indicated to a considerable extent by the on-time record of our locomotives in handling trains, anything out of the ordinary or, in fact, the current delays that may be due to motive power or equipment failures, are brought to my attention by telegraphic report from the superintendents. With regard to the installation of improved devices or devices to take the place of those that may already be on our locomotives, when a question may come up either as a result of information that has come to me direct or through one of many representatives I plan to have the matter investigated, particularly by the mechanical engineer as to merits, etc., after conference with him and other staff men, if I am convinced that it has sufficient merit to warrant or justify a recommendation to our vice president and general manager in charge of operation, I present the thing to him.

In the ordinary course of business I am in touch with what is being done in the way of maintenance work on locomotives and

various types and appliances thereof, to this extent: I have staff men at office adjoining mine, who are in contact currently with routine maintenance. I personally visit our general repair shops on an average of once a week. I visit our more important engine terminals probably on an average of once in 60 days. Any matters that may be outstanding I usually, under those circumstances, on my visits, check up with the officer on the ground, the officer in charge, to get some first-hand details pertaining to the difficulties that may have occurred. These staff men report to me from time to time, both as to maintenance and also as to operations. I also have some staff men who are in the field on operations, as well as the maintenance staff.

1602 I do not have to rely on these sources of information to know what has been done about equipping locomotives with power reverse gear. I know of my own knowledge what has been done in this matter (page 5632–5637).

During my experience with the New Haven, going back to my period as master mechanic, I probably rode locomotives one or more each day. Occasionally I would handle an engine. I did not do that as a regular thing because I was not qualified as an engineer, but I did that occasionally, and in riding engines, both main line and side line, as master mechanic I was on most of the engines in our territory; in fact, I did most of the covering of my territory by riding locomotives. Also as a district master mechanic or mechanical superintendent I spent considerable time riding locomotives in connection with their operation, so as to be in closer contact with that part of railroad operation in which I was more vitally interested. Before coming to the New Haven I was master mechanic on the Erie Railroad, general superintendent and later on master mechanic, and resigned on the Erie as master mechanic to accept a similar position on the New Haven. I served an apprenticeship as a machinist apprentice with the Baltimore & Ohio, and subsequently worked for the Baltimore & Ohio and other railroads as gang foreman, roundhouse foreman, general roundhouse foreman, and shop foreman. I was never a roundhouse foreman of engines on the New Haven. My first position with that road was machine mechanic.

I had no experience whatever with the power reverse gear prior to my New Haven experience. With respect to hand reverse, as a shop man all around the shop, and as a foreman, it was a very common practice on all the roads I have mentioned for me to handle engines out of the house on to the turntable, off the ash pit on to the turntable and back to the house, movement depending altogether on circumstances. I have experienced the handling of reverse lever when out on the road on some occasions. Before coming to the New Haven my experience was confined to the manually operated reverse gears. I have not operated or handled the power reverse gear.

1603 I have observed them in operation at various times while riding the engines in the way I have explained and around shops and terminals also.

Prior to the development of power reverse gears, and prior to the year 1916, all locomotives on the New York, New Haven & Hartford Railroad were equipped with hand reverse gears. The heaviest and most powerful of these locomotives were consolidations weighing 184,000 pounds on drivers, cylinder 24″ in diameter by 32″ stroke, and carrying a boiler pressure of 180 pounds. These locomotives were equipped with piston valves and Walschaert and Baker valve gears. Locomotives built prior to 1907 were practically all slide valve engines equipped with Stephenson valve gears. From 1907 to 1913 some engines were built having slide valves and Walschaert valve gear. Beginning in 1913, locomotives were generally equipped with piston valve and either Walschaert or Baker valve gear. The manually operated reverse gears applied to these locomotives were properly designed to suit the locomotives to which they were applied, counterbalance springs being employed to compensate for the weight of the valve gear parts lifted by the reverse gear, and these reverse gears are not difficult to operate.

Manually operated reverse gears have long since passed the development stage, and have been perfected in design and material, to such an extent that they are simple, reliable, positive, and seldom break or fail. We have never had a request through an employe individually or through any organization of employes or officials of any organization of employes to equip existing locomotives now equipped with hand reverse gear with the power reverse gear as a safety measure.

The power reverse gear was developed originally for use on Mallet or Articulated locomotives, that is locomotives having two complete sets of valve mechanisms, and as simple locomotives continued to grow in size, difficulties began to be encountered in designing them so as to permit of the practicable and convenient application
1604 of hand reverse gears. The extreme width of cab being fixed by clearance limitations, and the width of the fire-box continually increasing, the available space between the fire-box and the cab kept diminishing, making it difficult to apply a manually operated reverse gear. In this period also other developments were taking place, such as the application of superheaters, feedwater heaters, etc., which resulted in the necessity of an ever increasing number of parts being applied to the back head. These conditions taken as a whole resulted in its being highly impracticable to obtain the necessary room in the cab of the modern locomotive for the application of a hand reverse gear. The main reason for the application of power reverse gears on modern locomotives is simply due to the difficulty from a design standpoint in applying a hand reverse gear.

On the N. Y., N. H. & H. Railroad in 1916 power reverse gears were applied to new Mikado type locomotives weighing 185,850 pounds on drivers and 240,000 pounds on drivers. In the same year also they were applied to new Pacific type locomotives weighing

176,000 pounds on drivers. These were all Ragonnet type A gears having 9″ cylinders. These gears have been a constant source of trouble and maintenance on account of their creeping, which has resulted in a relatively high fuel consumption. In 1918, power reverse gears were applied to new Santa Fe type locomotives, weighing 295,350 pounds on drivers, these gears also being Ragonnet type A having 9″ cylinders. On these engines the same trouble has been experienced, and we have been continually experimenting in an endeavor to find some means by which the gears can be made to operate properly, but have not as yet been able to reach any solution. In

1919 ten U.S.R.A. light mountain type locomotives weigh-
1605 ing 227,480 pounds on drivers were obtained equipped with

Lewis reverse gears. These gears were very unsatisfactory, and they are being replaced with another type of gear, which it is hoped will prove to be more satisfactory. In 1920 and 1924, 40 Mountain type engines weighing 230,500 pounds on drivers were obtained equipped with Ragonnet type B gears with 10″ cylinders. These gears have not eliminated the difficulty experienced due to gears creeping. In 1926, seven Mountain type engines weighing 246,500 pounds on drivers, and three weighing 356,800 pounds on drivers were obtained equipped with the Barco B–3 gear with 10″ cylinders. These gears have given a lot of trouble through certain mechanical and structural weaknesses in the design, and it is contemplated replacing them with an improved type of the same gear. In 1928, ten Mountain type engines weighing 261,000 pounds on drivers were obtained equipped with Barco B–4 gears having 10″ cylinders. Both types of Barco gears have given trouble due to creeping, which the manufacturer is now attempting to eliminate. On switchers Alco, gears having 7″ cylinders were applied to three 8-wheeled switchers weighing 202,500 pounds on drivers, which were built for the Central New England Railway in 1913, and were taken over by the New York, New Haven & Hartford in 1927. From 1920 to 1923, thirty-five 8-wheeled switchers were built weighing 216,000 pounds on drivers which were equipped with Alco type E gears having 10″ cylinders. In 1924 there were ten and in 1927, six 8-wheeled switchers built weighing 247,000 pounds on drivers, to which Alco type E gears having 10″ cylinders were applied.

While power reverse gears have been materially improved, we do not consider that they are as yet perfected, and they are all sub-

ject to creeping, and require special attention and maintenance
1606 to prevent air leaks, causing erratic action. We do not believe

that locomotives equipped with power reverse gear can be operated with as econonomical a fuel consumption as a locomotive equipped with hand reverse lever, as with the power reverse gear it is not possible to obtain as close nor as positive an adjustment of the valve gear as can be obtained with the manually operated reverse lever. Our experience has been that the power reverse gear as developed to date is not as reliable as the hand reverse gear, as evidenced by the

attached statement, exhibit no. 73, showing a summary and details of engine failures and train delays caused by power reverse gears and manually operated reverse gears for the years 1928 and 1929. In the two-year period 1928 and 1929 we had seven engine failures directly due to the failure of the hand reverse gear. These seven failures resulted in a total detention of trains of 146 minutes, or an average detention per failure of the hand reverse gear of 21 minutes. The average mileage per failure was 3,153,727 miles (pages 5638–5647).

(At this point counsel for complainants moved to strike out the above testimony beginning with the words "our experience has been, etc.", on the grounds that it is purely a self-serving statement and that complainants have no means of cross examining as to the occurrences which have been decided in this exhibit, and which have been attributed to failure of power reverse, of anything else, and that a knowledge of the facts might lead to a different conclusion than that the loss of time or delay was due to the failure of power reverse gear.)

(At this point a statement consisting of six pages was submitted by counsel for defendants and marked for identification as exhibit no. 73, Witness Moriarty.)

WITNESS (continuing). Where the cause of failure is shown on exhibit no. 73, that is an exact quotation of the cause as shown
1607 on the records from which the exhibit was made. The information shown on this exhibit with respect to engine failures is taken from the engine failure sheet. We have a separate report, on a printed form with respect to each engine failure. This information was not taken from that report but from the report of the several divisions where the failures are all combined. The report on the printed form made up by the engineers has more information in a general way than the summary report, but the cause is the same that is given by the engineer to the train dispatcher, but he goes into a little more detail when he makes out the individual failure report on arrival at the terminal. These train delay or failure sheets are records kept in the regular course of business.

(At this point counsel for the parties discuss the competency of the reports on engine failures; the receipt of such reports being objected to by counsel for complainants, examiner rules out exhibit no. 73 and testimony relating thereto until the outlying records are produced.)

WITNESS (continuing). In the same period we had 28 engine failures directly due to the power reverse gear, resulting in a total detention to trains of 1,082 minutes, or an average detention per failure of the power reverse gear of 39 minutes. The average mileage per failure was 624,496 miles.

This record shows the number of failures of the hand reverse gear to be one-fourth of the failures of the power reverse gear in

the same period; the average detention per failure for the hand reverse gear approximately one-half that for the power reverse gear, and the mileage per failure for the hand gear practically five times the mileage per failure for the power reverse gear.

With regard to the contention that a locomotive equipped
1608 with a manually operated reverse lever is dangerous and unsafe to operate, and that the operation of the reverse lever does not allow the engineer to maintain a proper lookout for signals or crossings, would say that from my observation and experience it is unnecessary for an engineer to place himself in such a position that he would be liable to be injured in the event of failure of the hand lever or related parts. With respect to the impossibility of maintaining a proper lookout, would say that from my observation and experience, there is not much difference in this respect in hooking up an engine whether equipped with a hand reverse lever or a power reverse gear. When an engine is actually reversed, it is usually standing still, and when in motion in the process of hooking up as it is called, where equipped with the power reverse gear, from my observation, the engineer in performing this operation, will grasp the reverse lever with the left hand, and usually with the right hand sort of space off the quadrant the number of notches he wants to hook the engine up, leaning over and watching closely to see that he does not hook the engine up too far, this momentarily taking his attention away from a lookout ahead. In any event, however, whether performed on an engine equipped with a hand or power reverse gear, this operation requires but a comparatively short time, and takes up the engineer's attention only momentarily. It is not required to be performed at any set time, but opportunity can be taken, when a straight unobstructed length of track is reached, and it is seen that the coast is clear, to hook up the engine.

In our estimation, the application of power reverse gears to the existing locomotives on the N. Y., N. H. & H. Railroad not now so equipped is undesirable and unnecessary, as the hand gear with which these locomotives are equipped is easily operated, gives more permanent, positive, and closer adjustment of cut-off, resulting in less consumption of fuel, and furthermore does not constitute a
1609 hazard or render the locomotive dangerous or unsafe to operate. To equip the locomotives on the N. Y., N. H. & H. Railroad now equipped with hand reverse gears, of which there are 543, would cost $352,950. This is based on actual application costs of a reverse gear, which from our experience to date we have found gives the most satisfactory performance. We consider this expense unnecessary and unjustifiable from any standpoint.

During the year 1929 and New Haven Railroad spent $798,769.38 for improvements to steam locomotives (excluding new locomotives), which improvements were considered desirable, but did not include application of any power reverse gears. Exhibit no. 74 attached shows

the comparison of operating revenue and other operating statistics for the years 1928, 1929, and 1930, and for the first seven months of 1931, as compared with 1930.

(Statement above referred to as exhibit no. 74 presented by counsel and so marked for identification.)

Witness (continuing). Reduced appropriations in 1930 made it necessary to reduce the expenditures for steam locomotive improvements by 49.3 percent as compared to 1929, and the expected expenditure in 1931, as reflected by the first seven months, will be 62.5 percent less than 1930. There are many improvements to our locomotives we would like to make, but which will have to be deferred on account of lack of funds in the present emergency, as it is absolutely necessary to conserve every dollar available for the current maintenance of our locomotives and appurtenances already applied in safe and suitable condition for operation. To divert any part of available funds by applying power reverse gears would impair rather than promote safety.

1610 (Counsel for complainants moved to strike above testimony beginning "It is absolutely necessary, etc.", on the grounds that it is a conclusion of the witness as to whether spending money would impair or promote safety. Denied.)

WITNESS (continuing). The total expenditures for steam locomotive improvement for years 1926, 1928, 1930, and seven months of 1931 are as follows:

Statement of expenditures for improvements to steam locomotives

	Expenditure
1928	$546,871.88
1929	798,769.38
1930	404,837.41
1931 (7 months)	91,468.25

The proposed expenditure for power reverse gear is equivalent to 44 percent of the total money spent on steam-locomotive improvement in 1929 and 225 percent of the expected expenditure during 1931. This indicates the extent to which necessary work would have to be deferred were the application of power reverse gears made mandatory, even though spread over several years.

Details as to pay roll expenditures at Readville locomotive shop (the only back shop in the system) for years 1928, 1929, and 1930 and seven months of 1931 are as follows:

Statement of pay roll expenditures at Readville locomotive shop

	Pay roll
1928	$1,770,958.98
1929	1,782,560.88
1930	1,242,728.76
1931 (7 months)	662,042.71

1611 The 1930 pay roll was only 69 percent of the 1929 pay roll. Present indications are that the total 1931 pay roll will be about 85 percent of the 1930 pay roll and only about 60 percent of the 1929 pay roll.

In the fall of 1930, when the budget for 1931 was established, and when it was thought that business might soon show recovery, a budget was recommended which called for an expenditure of $11,468,153, of which $7,355,781 was chargeable to capital. (This excluded the cost of new equipment.)

The principal items included were the installation of heavier rail, third tracking on the heavy density main line between New Haven and Providence, the replacement of main line wooden trestle bridges by modern steel bridges, the elimination of certain grade crossings and various improvements to signal and electrical systems, freight yards, stations, and other facilities. It also contemplated further improvements, and in some cases rebuilding of freight cars, improvements to steam and electric locomotives and other equipment. However, because of the serious situation confronting the railroad, it has been necessary to postpone all of these improvements that can be postponed, and as a result, the charges to capital in the first seven months of 1931 totaled $1,111,835, as compared to an actual a year ago of $3,285,550, i.e., this year's expenditures to date are running only about one-third those of a year ago. When business gets back to normal volume, it is to be expected the improvement program will be restored as warranted, but at the present time the traffic is so light that in many cases there is not the same need for some of the improvements that exists in times of normal business. Certainly such funds as may become available can be expended with far more benefit to the operation and service than by applying power
1612 reverse gears to small old locomotives that will, in any event, pass out of the operation within a few years, and which are used in light service (5647–5659).

The budget just referred to was a joint proposition by the representatives of the maintenance, transportation, and mechanical departments presenting our recommendations for the work that we contemplate and will want to perform in the year 1931. That is the combined expenditure that the different departments expected to make. I know that, as a result of being present when the things were discussed.

(At this point counsel for complainants objected to witness' testimony with respect to the budget above referred to on the ground that the matters discussed are outside the jurisdiction of the witness, references being made to rail and the various improvements to signal and electrical systems, freight yards, stations, and other facilities. Denied.)

WITNESS (continuing). The records indicated in exhibit 74 are in the office of the statistician. I have nothing to do with the making up of that report, except such information as may be furnished and is combined in it affecting my department. I think a statistician in my department who takes care of statistical matters, in so far as the department is concerned, supplied it to the general statistician

who prepared this statement and is a member of the staff of the vice president and general manager.

(Exhibit 74 ruled out by examiner.)

CROSS-EXAMINATION

In the last two years 66 percent of the engines operated on our property have been manually equipped. Five hundred and forty-three engines are manually equipped and there are 264 with power reverse, I believe. Our power-reversed engines, outside of 51 switch engines, are what we recognize as our more modern power. If business recovered and I were buying modern power now, I would buy power reverse gears, because of the difficulties to design
1613 and install a hand reverse gear on modern power, and, further, the fact that I am interested in and expect that a power-reverse that will be equally reliable to the hand reverse gear will eventually be developed. I would be compelled to, due to the design conditions. I could not get away from it. But I have also in mind the possibility—and we, as one railroad, consider power-reverse, as well as other devices that have possibilities towards making more convenient operation for our crews or other employes, and we want to go along with it. By that I mean that the changes due to wider fire boxes, that is, the conditions which can be obtained by making the clearances closer, are sufficient to overcome any objectionable features that arise out of the power reverse gear.

I have installed power reverse on 10 engines formerly equipped with manual reverse. I think the 10 of them are now complete. That extended over a period of possibly a year and a half. They are the Consolidated 2–8–0. The weight on drivers is 185,000 pounds. These engines were originally purchased in 1913 for freight service. We subsequently purchased larger power, and those engines, in so far as operation in freight service for which they were originally purchased is concerned, became too small, obsolete. They were then relegated to local or branch-line service, and still later to switching service. There were 15 of them, and formerly 10 were put into switching service. With the placing of these engines in switching service we had an informal request to equip those engines, inasmuch as they were among the heaviest switch engines we had and much heavier than anything else operating on these jobs, to put power reverse on them. We had at about this time decided to try out a further improved power reverse gear on a class of power we had gotten in 1918, 10 Mountain type engines. They had a reverse gear on them that, in view of the service which they were in, which
1614 was important freight service, that gear gave a lot of trouble. We took the gear off and instead of retiring it for scrapping, I got the approval of the vice president and general manager to apply it to these Consolidated engines that were put in switching service.

The informal request came from some of the engineers who were operating, through their master mechanic and the mechanical superintendent to me. The considerations which led us to put on the power reverse gears were that these men who asked for them felt that the application of such gears on those switcher engines would be a convenience to them, and they thought they might be able to perform a better day's work. However, since the gears have been put on I have had men that were operating the engines tell me that in so far as performing any faster with that engine now that it is equipped with power reverse, as compared to hand reverse, it did not accomplish that result.

(Motion made by counsel for complainants to strike out the portion of preceding testimony with respect to what the men told witness as to performance of the power reverse, granted. (5659–5667).

WITNESS (continuing). It was the Lewis gear which were put on those engines. They were put on within the past two years. They are still on those engines. We have not taken any off. I believe that the Lewis gear is probably getting into the obsolete class. I could not say whether they are making them any more, because I am not ordering any or putting any of them on. These are the only engines that we have utilized or put the power reverse gear on, except as new were purchased. I do not think the Lewis gear is the best gear and even if it were on the market I would not buy one.

With respect to the problem of accidents from reverse gears it is part of my responsibility to acquaint myself with conditions, so far as it is practicable, or anything that might represent a hazard to our employes. I have made a study of the accident in so far as it is possible from my knowledge of the details of those things.

1615 (Question as to whether witness is familiar with reports made by his company to the Interstate Commerce Commission of accidents resulting from the handling of reverse gear, objected to by counsel for defendants as not proper cross-examination because witness has no familiarity with any tabulation of accidents, nor has he made any showing with respect to the number or the absence of any accidents. Witness permitted to answer because in his direct testimony he stated that the hand gear does not render the locomotive unsafe to operate, nor does it constitute a hazard.)

WITNESS (continuing and answering the above question). I have some knowledge of them. I believe there is something in the record here of accidents which occurred on our road during 1929 and 1930 resulting from the operation of power reverse gears. There was one that I have in mind, a witness who was on the stand here by the name of Landers, that on account of the power reverse gear condensation in the air, freezing and locking of the equalizing valve, and attempting to thaw them out, burnt one of his hands. I think that occurred in 1930. That is the case where the piece of waste hit him on the hand. I can't say whether in the same period there were any reports made to the Interstate Commerce Commission of accidents with

manual reverse, although I think there were. In making the statement that the hand gear did not render the locomotive unsafe to operate, I made it with the thought of expressing an opinion as a result of experience, that in so far as its operation was concerned the hand gear was not hazardous to the employee. It was not my intention to make a statement that we never had any accidents due to the use of hand reverse. They are rare but we have had them. My statement was made from what I know from experience. I made a survey of the reports of my company of injuries resulting from the manual reverse gears during 1929 and 1930 but did not check them minutely. Whether the fact that 11 accidents with manual reverse occurred during 1929 and 1930 on our road, while none occurred with power reverse, fails to support my statement that the manual
1616 reverse presented no hazard, would depend very largely upon the character of the accidents. (After looking through the 11 reports.) In view of the nature of the accidents and the various claims, I still maintain my position that the hand operated lever is a safer apparatus than the power reverse. Those accident reports indicate no failure of the hand reverse gear. I would not say whether there are any accidents among the 11 shown on exhibit 30 which would not have occurred if the engine had been equipped with power reverse. The accident which occurred to William J. Delaney, as shown in exhibit 30, while "he was pulling on the reverse lever when his foot slipped resulting in a strain of the muscles to the abdomen", could not have happened so far as the foot slipping is concerned if the engine had been equipped with power reverse, but still I am not convinced that there was any defect in the hand reverse gear that was responsible for the accident. Some of the accidents reported may have been due to a broken equalizing spring or an improperly adjusted equalizing spring but running over those reports hurriedly I do not see that it is indicated that such condition prevailed. My opinion of the safety of the manual reverse is based solely on accidents happening from defects in the manual gear (5667–5675).

I know that since May or June of this year there have been three accidents on our road to engineers on engines equipped with manual reverse. I am not clear as to the details with respect to an accident to Engineer Patrick Deady at Mamaroneck, N.Y., when the reverse lever kicked back and lacerated his foot. I was running through my mind if the information furnished me in connection with that was not a case where the individual was directly responsible for having been injured through the handling of his reverse lever. He was directly responsible. I won't be positive.

1617 (At this point counsel for complainants present bulletin dated August 31, 1931, issued by the New York, New Haven and Hartford Railroad Company containing statement with respect to accident to Engineer Deady, which was marked for identification as exhibit 75.)

WITNESS (continuing). I have seen the bulletin. It was issued by C. N. Woodward, in charge of personnel. The item marked August 20 reads "Patrick Deady, engineer, at Mamaroneck, N.Y., engine lever kicked back lacerating foot."

(Counsel for complainants offers the foregoing quotation in evidence. Counsel for defendants object on the ground that such is not proper cross-examination and that the item shows no details with respect to the accident and affords no opportunity for getting the full facts regarding it, and that it should have been offered as part of complainants' case if counsel wanted to prove that accident.)

WITNESS (continuing, answering question by examiner as to whether this was a hand or power gear). It was a hand gear. I am familiar with those engines and know what they have got on them. I know the engine from the number he (counsel for complainants) gave me.

(Counsel for defendants moved to strike out answer with reference to hand gears. Motion granted.)

WITNESS (continuing). Such information as came to me in connection with Patrick Deady's accident led me to believe, so far as I can remember, that it was due to some carelessness on his part. All of the injuries which happen on our property in connection with manual reverse are not the fault of the men. Occasionally we have a failure of some part that might result in an accident.

(Bulletin previously marked for identification as "Exhibit 75" received in evidence.)

WITNESS (continuing). With respect to the accident that occurred to Engineer Wellington Eddy on engine no. 1311, class I–2, on January 9, 1931, I know that the engine on her return to our Cedar Hill enginehouse was inspected and no defective
1618 condition found with regard to the hand reverse gear on that engine. I do not know whether he is still off duty. I do not know whether that was reported to the Bureau of Statistics. It would be reported by the general manager's office.

(Upon admission by witness that his knowledge concerning the accident to Engineer Eddy is based upon hearsay, such evidence was ruled out by the examiner.)

WITNESS (continuing). I do not recall the accident to Engineer D. F. Kelleher in which he broke his wrist underneath the manual reverse lever on May 28, 1931. I have not made any check of recent accident records for the purpose of filling out any part of my testimony (5675–5682).

REDIRECT EXAMINATION

I do not know anything about the 11 accidents during 1929 and 1930 other than what I acquired from looking at those reports here today. Notwithstanding those reports I still feel, as a general proposition, that the hand lever is safer than the power reverse. The hand

lever is reliable inasmuch as it can positively be locked in some definite position without the possibility of some failure of some valve or other that furnishes the power, delivering that power at a time when the gear might perform some erratic action and possibly injure somebody that was working around it. I think the feature of the hand lever being positive in adjustment and locking position is the distinguishing feature which makes the hand lever safer than the power. I have had no record or investigation made as to whether the Consolidation engines which were changed over from hand to power reverse and placed in switching service performed any more work in a day with the power reverse gear than when they were equipped with hand levers. I think we have some of those engines still in switching service which are equipped with hand levers. I could not say definitely. I have got 15 of those engines and
1619 I contemplated equipping 10 of them with these hand reverse gears which were taken off other power. Those 10 generally would be operated in switching service or local freight service. They go as the emergency might arise, and go back onto local freight occasionally from which they were taken when they were finally taken out of switching. I would not say that all the power reverse gears we now have will become obsolete if and when a power reverse gear is designed that will not creep. It is possible that some of the gears that are now on the New Haven, with the changes that might be made to overcome the trouble which we have, might be applicable or might be adapted to the present gear so that we could use them. Otherwise it would be almost prohibitive to have to replace all these gears with new gears. Undoubtedly there are some of them with the improvements that will eliminate the creeping effect could be adapted to those that are now in service. We have not discovered as yet the secret of making them so that they won't creep.

RE-CROSS-EXAMINATION

The manual reverse gear can be positively locked so that there is no possibility of it doing any erratic. Witness excused (5682–5686).

At this point counsel for defendants presented accident reports in connection with previous testimony of Witnesses Snyder, Moore and Glover, which were received in evidence and marked "Exhibits Nos. 76, 77, and 78," respectively.

Counsel for complainants calls attention to previous discussion in connection with defendants' exhibit no. 53, introduced when Witness Burnett of the Union Pacific was testifying, which purported to show a greater number of reverse gear casualties than did complain-
1620 ants' exhibit no. 13, both of which exhibits were compiled from the Interstate Commerce Commission annual statistics for the years 1929 and 1930. Counsel points out that a check of these exhibits reveals that exhibit no. 53 shows 227 casualties, while exhibit no. 13 shows 231.

In connection with a previous statement by the examiner that the records of the Bureau of Locomotive Inspection indicated that there had been more accidents caused by reversing gears than from any other cause, counsel for defendants points out that a check of the reports of investigations by the Bureau for the 11-year period 1920 to 1930, inclusive, reveals that there have been at least two other classes of injuries that have been investigated by that Bureau which are more numerous than reversing gear injuries, namely, grate-shaker injuries and squirt-hose injuries. There were slightly less than 100 squirt hose accidents more than the number of reversing gear accidents, and probably 30 or 40 grate shaker accidents in excess of reversing gear accidents, during the same period (5687–5691).

WILLIAM A. COTTON, mechanical assistant in the employ of the Erie Railroad, living at Cleveland, Ohio, testified:

I have been employed in the mechanical department of the Erie Railroad about 40 years and have charge of the collection of data with respect to the various activities of that department and have collected certain data with respect to the matters here involved.

On December 31, 1930, the Erie Railroad had 570 locomotives equipped with power reverse gears, 74 with screw, and 435 with hand lever, a total of 1,079. In the usual course of railroad operation it is assured, or reasonably to be expected, that some of these locomotives which are now equipped with the manual reverse gear will be retired, but not because of this equipment. That will not be given any consideration in determining whether they should be retired.

(Counsel for complainants raise the question as to whether witness is qualified to answer questions as to what matters will determine the retirement of engines, or what will not.)

1621 WITNESS (continuing, in explanation of his qualifications to testify as to the above matters). I do not have any jurisdiction at present upon the question of the retirement of locomotives, but I have full knowledge of what is going to be retired. I assist in preparing all data in connection therewith, and in conjunction with the superintendent of motive power I work up the schedule for retirements. I know that age and obsolescence is the factor that enters into the retirement of locomotives. In other words, the lighter power eventually is retired first. I do not determine what engine shall be retired or when an engine will be retired. That is the duty of the superintendent of motive power. I furnish him with the information that he asks for. My previous statement to the effect that manual reverse gears have nothing to do with the retirement of a locomotive is based on past experience.

(Examiner permits witness' testimony to stand.)

For the years 1928 and 1929 we had a total of three hand reverse failures. The mileage for engines equipped with hand reverse gear was 5,389,140 miles, which would make the miles per failure 1,796,380. For the power reverse we had 25 failures in the same period and the mileage of those engines was 10,283,039, or an average of 411,321.

I do not happen to have data about the screw reverse. The total mileage for the railroad in 1928 was: engines equipped with power reverse gears 16,571,408; with hand reverse 12,190,996; for 1929, power reverse 18,682,239, hand reverse 11,003,723. The heaviest locomotives we have with hand reverse gear are the H–21's, type 2–8–0. They weigh 187,675 pounds on drivers.

* * * * * * *

No cross-examination.

(Witness excused.) (5691–5697.)

1622 J. E. INGLING, general supervisor of fuel and locomotive operation for the Erie Railroad, with residence at Ridgewood, N.J., testified.

My headquarters are in Cleveland, Ohio. I have held the following positions with the Erie Railroad: locomotive fireman, roundhouse foreman, locomotive engineer, road foreman of engines, train master, superintendent of freight service, assistant to general manager, and general supervisor of fuel and locomotive operation, which I hold at present.

The Erie first purchased locomotives equipped with power reverse gears in 1911. They were the Mikado type and the first class of engines the Erie had used so equipped. They were not larger and heavier than some previously used on the Erie, but the N–1's, the Mikado type, were the largest road freight locomotives. One of those earlier types was called the "Mat Shay." I think we had three of those. They have been torn up long ago. They were more or less experimental. The purpose in acquiring this type of locomotive to which I have just referred was to lower the cost of hauling freight per gross ton mile. (Objection by counsel for complainants to this latter statement overruled.)

The over-eves dimension of the cab is 10 feet 7 inches on the outside. The clearance on the inside between the lagging and the inside of the cab is 16 inches. The various appliances attached to the locomotive within the cab all reduce the clearances. From my personal knowledge due to having operated such engines, I can state that there is not enough room in the cab for the operation of this hand reverse lever, the Johnson bar. I could positively state I do not know where they could put it. There is not enough room to place it and operate it. I have had experience in running these engines which were so equipped. We had a lot of trouble with the first 20. They had the early Ragonnet type of power reverse
1623 gear, known as type A. The gear was unreliable. The creeping was exceptionally bad. We had several accidents due to the engineer reversing the gear and the valve motion not responding. I recall one very clearly. I happened to be right in the vicinity. An engineer had pulled in the siding—I went there. I saw it. I went there immediately and tried the gear myself in order to see if the engineer was right in his version of the accident. I reversed

the gear and the valve motion did not respond. That was after the engine was derailed (5697–5703).

The next type of reverse gear that was employed on newly acquired locomotives was the hand screw reverse. We got 65 of those locomotives in 1912. We did not continue to use this manual screw gear exclusively. To the balance of that order the improved Ragonnet type A was applied. We came back to the power reverse gear on the other locomotives because they had overcome one of the objectionable features of the gear. The valve gear not responding properly with the reverse lever in the cab. I do not regard the power reverse now in use as being a perfected instrument but the railroads and the manufacturers are working together trying to overcome the objectionable features. The principal objectionable feature of all types was the creeping. They went to the Precision gear, which is a later type, and the creeping feature had been practically overcome, but owing to the manner in which it was hooked up between the valve gear and the operating wheel in the cab, it has now gone to what you might term jumping—or instead of a jump there is really a twisting motion continually on the operating wheel in the cab, and that quite frequently tears the notches out, breaks the latch, and has torn the entire center of the wheel out.

In order to overcome some of these objectionable features we have applied to our heavy type freight locomotives, what is known as a friction box on the tumbling shaft in order to prevent
1624 this gear from giving that continual motion. This friction box is applied with such a tension that the engineer, with two hands, can just operate the wheel in the cab, in the event that the air goes out. The friction box we now find, when in the cab of the locomotive, grease or oil being spattered on this tumbling shaft box gets into the bearings and just ruins the purpose of what the bearing was placed there for, and it is necessary then to dismantle it and clean out the bearing in order to put it back and get into its original condition. I might say that the bearing does not want any lubrication. It is a dry bearing.

I have operated both types of engines. From my experience and observation I can not see that there is anything in favor of the power reverse gear over the hand reverse gear from the standpoint of safety alone. I think that they are about fifty-fifty. Some things are good with the power and on the other hand some things are good with the hand reverse. The screw gear is probably just as safe as any. In making this statement I am speaking of the power reverse gears which we now have on the Erie. With respect to new gears to be applied in the future, unless they can overcome the trouble we are having with this Precision gear, I would say the power gear is not as safe as the hand gear, but we can not put the hand gear on. If the Commission ordered the power gears off of all locomotives on the Erie on the ground that they are less safe than the hand gear the only thing that I could see is we would have to put the screw reverse

gear on all our later type locomotives. The clearances would permit the installation of the screw gear. The N–1's had the screw gear. I do not know what the expense would be.

From my own experience in the operation of locomotives equipped with power reverse gear I know there is increased fuel consumption when this reverse gear creeps. Any locomotive
1625 which does not stay where put is going to increase the fuel and water consumption. The reason why we did not put the hand screw gear on our later power instead of the power reverse gear was that the screw gear is inefficient. By that I mean it takes entirely too long to reverse the engine. There are entirely too many turns to be made of those wheels. As to which of the three types of gears, the hand lever, the hand screw, or the power, is the least safe, I would say that on our railroad the Precision gear has proved to be the less safe of the three. The reason we have continued to put them on is because we haven't anything else to put on except a screw gear, and with the friction box we have been able to overcome some of the objectionable features to it. As I stated the power gear people are working on an attachment now to go on the Precision gear in order to reduce the tremendous shock registered on the operating wheel in the cab. They possibly can overcome it but have not done so yet. In determining the question of whether power reverse should be used or discarded I think that on the modern engines of today the clearances would have to be taken into consideration first. If the clearances are such that you can't consider anything but a screw gear or power gear I do not think there would be anything to do but to recommend the power gear with the hope that they will overcome the objectionable features.

(No cross-examination.)

(Witness excused.) (5703–5711).

C. J. GERBES, master mechanic with the Erie Railroad, residing at Hawthorne, N.J., testified.

I am located at Secaucus, N.J. As master mechanic I have supervision over the inspection of locomotives and their repairs. The inspection of a locomotive equipped with hand reverse is made by the regular locomotive inspector. If there are any
1626 minor repairs needed to the reverse gear they are made by any machinist who may happen to be called upon. In some roundhouses the locomotive inspector will perform minor jobs like tightening a nut. In our particular place he does not. Another machinist does that work.

(At this point the examiner requests Witness Cotton, who previously testified, to furnish information as to how many of the 435 locomotives equipped with the hand lever are out of service; and also as to how many of the three classes that witness mentioned are out of service, screw, hand, and power reverse, at this time.)

Witness GERBES (continuing). With respect to an engine equipped with power reverse gear there is a special inspection made by our regular air brake inspector in addition to that of the locomotive inspector. On the Ragonnet type of power reverse gear there are 20 visible parts which require inspection; on the hand gear there are 7. With respect to the time required to make repairs, there are outstanding repairs required on the power reverse gears, such as the application of packing leathers, the packing of the piston rods. The application of a packing leather takes on one type of gear approximately 1½ to 3 hours, where there is no work which can be compared with that on a hand operated gear. As to the number of years which would represent the approximate life of a power reverse gear and a hand reverse gear, both will wear indefinitely with a certain amount of repairs. I can not say that one as against the other will last a certain number of years without repairs. The hand gear would require minor repairs. On the Precision gear there are about 50 parts concealed. Periodical inspections are necessary and the gear must be dismantled in order to make inspection and repairs. The gear is entirely overhauled on the mileage basis of the locomotive when it goes into the shop for class 3 repairs. There are no invisible parts to the hand reverse gear.

1627 CROSS-EXAMINATION

I would say that on the Precision gear there must be at least 45 invisible parts; there are 75 parts in all. I can not name them off hand.

(Upon request of counsel for complainants witness proceeds to name from memory the various invisible parts such as bolts, nuts, retaining rings, cotter keys, slide valve, gaskets, packing leathers, piston, and various other items. The invisible parts on the Ragonnet are the slide valve and seat, the gaskets, the piston rod, and head, the nut which screws it on there, bolts which hold the packing leathers, your operating valve stem, its screw, the lock nuts which are on there, the cotter keys. These on one type. Then you have the reversing shaft on the other type, which is an additional part. There is nothing invisible that I know of about the manually operated gear. The bushings are invisible, but they can be tried with a bar.)

(Witness excused.) (5711–5718).

GEORGE M. BOH, district road foreman and fuel supervisor with the Erie Railroad Company, residing at Hornell, N.Y., testified.

I have been district road foreman and fuel supervisor since May 1929. For two years prior I was road foreman of engines. With respect to the matter of increased fuel, oil, and water consumption, on an engine equipped with power reverse gear where there was a

creeping condition, during March 1930 on the Buffalo division in the territory over which I have charge some dynamometer tests were made with a view of determining whether or not the present power that was in use on that part of the railroad was the most efficient, or whether it would pay to put on a booster-equipped locomotive. Accordingly, the dynamometer car was placed on there to test the engines which were then operating on that division. The type of locomotive was the N-2. About March 20, 1930, this dynamometer car was attached to a train, a fast freight, hauled by
engine no. 3200, and made the run from Buffalo to Hornell,
1628 a distance of 92 miles. The results were not as expected, and
the locomotive being maintained at Buffalo was immediately turned at Hornell; also they got in touch with me and the district master mechanic issuing instructions that I accompany them to see just what the disturbance might be. This locomotive was equipped with a Lewis hand lever power reverse gear, and the instruments in the dynamometer car, together with my experience as a locomotive engineer, told me at once that the locomotive valve gear was creeping. We continued the trip to Buffalo, taking the same water, tonnage, pounds of coal, etc., in every sense of the word, which might be taken on a dynamometer car and get the complete data they wanted, in order to put the engine in condition. Of course, she was my baby, and that was what I was on there for. I tested the gear at Buffalo to find out what the trouble was and had it corrected. We went out on the succeeding trip, on the same train, the same schedule, same number of cars, and, as nearly as possible, the same tonnage, and the decrease in fuel consumption was 3,800 pounds for a 92-mile trip or about 41 pounds per locomotive mile—not a very big item and if you were firing the locomotive by hand—any one who might be inexperienced and was riding a locomotive on such a test as that would hardly pay any attention to 41 pounds on a heavy locomotive per locomotive mile, as it would be a little less than the average we figure on for three hand-fired scoops of coal with a no. 4 scoop. However, it would be a very attractive thing to me as a fuel supervisor if I were able to save one-half of that. We ran along for a succession of trips, and I let the road foreman of engines ride them for the completion of the number of trips.

The trouble which I found at Buffalo was a screw in the gear
cylinder bushing at a point about where the locomotive would
1629 be operated in forward gear, at running cut-off. It could not
have been detected by ordinary inspection. In other words, the repair man had taken the cylinder heads off a couple of times and examined the packing, but it required something more than that. I had another gear cylinder shipped from Hornell on a passenger train and had that applied to the locomotive so that it could go out the next day (5718-5721).

CROSS-EXAMINATION

The difference in the coal consumption was 3,800 pounds. I know that by the records of the dynamometer car, which was arrived at through a bucket weighing device installed tender and metering out the coal in the locomotive fire box. It ran something slightly over 14 tons on the trip that the locomotive was creeping, and slightly over 12 tons on the trip she was not creeping. In round figures the tonnage of the train was 2,600 tons, manifest time freight. It was the same on both trips within a very few tons, perhaps 7 to 10 tons. It was around 2,600. That was the mark, and we came as close to it as possible. In other words, if you had 2,393 or 2,395, you would not take another car. We determined the number of tons by the stenciled weight right on the cars and the weight shown on the way bills. The conductors are able to furnish us with that information before the completion of the trip, that is, between them and the yardmaster. I do not know that the stenciled weights are correct. I got the weight of the lading off the way bills accompanying the contents. I know that the Erie provides these cars be weighed and stenciled and whether the fellow doing the job there knows his business I do not know, but we take them anyhow. I do not know enough about the car department rules to tell whether when the cars come out of the shop and they are stenciled whether they are correctly stenciled until weighed and stenciled again.

1630 One trip was made from Hornell to Buffalo. She made a round trip from Buffalo to Hornell, and then I had the gear corrected. It was one round trip with the gear creeping. The most accurate records I could get showed 3,800 pounds difference. I was not on the initial trip from Buffalo to Hornell. I do not know what the experience was coming from Buffalo other than what their attitude told, and they were disgruntled over the performance. The valves could have been dry all the way from Buffalo to Hornell, I was not there. We did not have the same identical cars on the second trip after the gear had been repaired. I know that cars roll differently, but they were the same denomination of cars, that is what I mean, the same scope of cars. I know that because we did not pull coal dumps on the first trip. It was a stock train, running with about the same scope of freight, fast freight stock. I do not know what the condition of the brake rigging was on the first trip. I do on the locomotive, because everything concerned was in good condition, for nothing was done at Hornell. I do not know about the condition of the cars on that train. They reached the wind velocity on all their trips, but it would be too far-fetched for me to attempt to name those figures now without checking the record of temperature and such things as that. It was fine weather both trips. The outside temperature was above freezing. I did not notice any material difference in temperature between the test trips. It was what you would call fair

spring weather. The two trips that the engine was creeping were made on the same day; left Buffalo at 7 o'clock in the morning and set back, leaving Hornell at about 1 o'clock and arriving at Buffalo at 4 to 4:15. The other trip was made the following week. I do not have the figures as to the number of cars, but the locomotive went on the trip at 4:30 or 5:00 at Buffalo and immediately they went to
1631 doing business with the roadhouse foreman, and came out the following morning at 6 o'clock on no. 90, the same train. I would have to go back to my records to give the running time in hours and minutes on the first and second trip. There was no spread particularly in either case. The same engineer and fireman were on both round trips. The engineer's name is C. Danney. The engine number was 3200. The dates were from March 20 to 30, 1930.

I could get the exact dates from the records in my office at Hornell. To all visible appearances the fuel was of the same grade on both trips. I do not know whether it was obtained from the same mine. We were not running that kind of a test. Buffalo at the present time and then was supplied from fuel coming from four different mines, all of which supply coal entirely acceptable for locomotive purposes. The B.t.u. test would have been around 35,500. I do not know how the B. t.u. coal used on one trip would compare with the B.t.u. on the next. The dynamometer car records would show the delay in both or either of those trips. The engine stayed in Buffalo before making the second trip from about 5 p.m. to 6 a.m., 12 to 13 hours (5721–5729).

(Counsel for defendants expresses willingness to furnish the running time for the two trips. Examiner states he does not want such information particularly, but points out that where, as here, the difference in coal consumption is attributed to creeping power reverse gear it should be shown that all other conditions were equal, which witness was unable to do.)

WITNESS (continuing). I made an investigation as to the cut in the cylinder wall, to which I previously referred. To state what caused it would be far-fetched. Numerous things might have caused it. There is nothing working against the cylinder, inside the cylinder, except the leather packing. Something at some time or
1632 other scored or scrapped the cylinder wall. It was necessary to change the cylinder. The material for that purpose was transported on train no. 1 leaving Hornell at 5:17 p.m. and arriving at Buffalo 7:30 p.m. It takes about an hour to change cylinders.

I was a locomotive fireman, on hand-fired trains, from December 14, 1903, to September 9, 1907. From the latter date until September 1, 1914, it was about a 50–50 proposition, whether I was firing or running, running in the winter and firing in the summer. I fired steadily for four years in all kinds of service, freight and passenger, mostly through-line freight.

(Question as to whether witness has had any runs on freight where he would fire as much as 14 tons of coal on a trip, objected to by

counsel for defendants on the ground that it is not proper cross-examination. Witness permitted to answer.)

WITNESS (continuing, in answer to above question). The only way I could answer that is, in the old days, along about 1903 and 1904, we had locomotives that carried that much fuel and I have cleaned the tank and fired the locomotive by hand and possibly taken all of the coal. While hand-firing we were assigned to the same engine at certain times. When your seniority did get you a regular job, you were assigned to it. You would have the same engineer if you had a regular assignment. While hand-firing a locomotive I would make the same freight run practically day after day with about the same tonnage in the train. They would arrange that. Once in a while we would get out light, but generally we would run about the same tonnage. Like everything else, that stuff was not checked so close 25 years ago, and on a single-track railroad there would be some days in the week when the operation would be heavy, and if you were going in the other direction you would get stopped, whereas on light days, for the opposite movement, you would move
1633 right along. There would be times when weather conditions were substantially the same. I have had the experience in hand-firing where the coal consumption was in the neighborhood of 14 tons for the trip. It would vary from 1½ to 2 tons for the same trip, but the reason was usually something other than the quality of the fuel. It would be infrequent where the variation in the amount of coal consumed could not be accounted for. There would be delays or something to charge it to. In cases where varying quantities of coal were consumed I could not ascribe it to the running conditions of the train. I do not know that I ever lacked an answer. There might be something ailing the locomotive, that I was not keen enough mechanically to place my finger on, but I know there was something the matter with the locomotive. From my experience it was not a fact that there can be a variation of from 1 to 2 tons on a 14-ton trip which cannot be accounted for. You can have the variation all right, but a keen man with a locomotive, if he gets in touch with the conductor, and has any knowledge of weather conditions at all, ought to be able to find out what is responsible for it. It may not be the same thing in all cases, but he ought to be able to have some tangible evidence that he would ascribe as being the cause.

The engine on the test trips was stoker-fired. I have fired stokered engines in an executive capacity. We had no such animals when I was firing, at least on our locomotives. It is true that with the same engine, going over the same territory, with the same tonnage, even stokered, there will be a variation of coal consumption over the same trip. I compared the round-trip figures for this one particular trip out of Buffalo, and the trip on the road, and going out on four or five subsequent trips, and the variation showed in
1634 about every case a downward tendency after the gear was repaired. That is the point I was trying to make. I cannot

state the number of trips made after the gear was repaired, but I know I made two more. The fuel consumption on those trips was around 12 tons. The first trip, as I stated, was a little better than 14. After the repairs were made the consumption did not vary much between trips, maybe 100 to 500 pounds. This was caused by head wind and difference in temperature, possibly a move on the dispatcher's part. One morning we were running against an adverse head wind. Another morning this fellow was forced to detour around a freight train, having trouble on the grade out of Attica, stopping to open and close switches, to get back on his own track, etc. I do not know the amount of the head wind on the morning we had trouble with the gear. I did not accompany them except west. I cannot say that I ever fired the same engine which at one time was equipped with a manual reverse and at another time equipped with power reverse. I do not recall having any locomotives on my division that were at one time manually reversed and subsequently equipped with power reverse. As to the whole railroad I am not clear on the subject. Mr. Cotton could answer that question because he has the record. I have not made an actual test as to the coal consumption on a locomotive equipped with a manual reverse and on the same locomotive or one of the same type and weight equipped with power reverse.

REDIRECT EXAMINATION

My experience as fireman as to which I have previously testified was not over this Buffalo division between Buffalo and Hornell, but over the Allegheny division, between Hornell and Salamanca main line, the branch line extension over to Lake Erie from Salamanca.

(Witness excused) (5729–5738).

1635 FRANK PERSCH, fireman for the Erie Railroad, living at Meadville, Pa., testified:

I will have been employed by the Erie Railroad 19 years the 6th of next November. I am now employed as a locomotive fireman. I have been promoted to an engineer but am now back firing because there is no engineering work. I recall an accident which happened to me on May 5, 1928. The engine number was 220. It was a yard engine. The accident occur'ed on the westbound of the westbound of the Meadville yard. There was a train pulled into the yard. After the cut-off we went on track no. 3. After we coupled onto the train, the switchman went to put the air off and the air pump was squealing I had some time so I went out and oiled the air pump. While I was oiling the air pump I discovered that the lifting spring was out of place and the piston had been cutting. I went up in the cab and told the engineer, his name was Moffatt, that it would have to be temporarily fixed. He being a large man I went down to do it for him. I got the wrench and done the necessary repairs. After I done that I took the can and instructed him to reverse this

engine before I went down. I was down there and I had my hand on the set screw which holds the tumbling shaft coming over. I hollered for him to reverse the engine, while I put the valve oil on, and it caught the tumbling shaft as it came over in the back motion, caught these two fingers, broke that one, and split that down there [indicating]. The same accident could not have occur'ed if the engine had been equipped with a hand reverse gear because that set screw would not have been there.

CROSS-EXAMINATION

When I asked the engineer to reverse the engine I knew that the tumbling shaft was going to move backwards, but the tumbling shaft was over in the forward motion, and I had put my hand on that set screw. When I put my hand there I did not know that it would get caught on the set screw if the tumbling shaft came back,
but it did. The purpose of the set screw was for the tumbling
1636 shaft coming back to rest on, but I did not know, when putting
my hand on there first, that it was for that. The set screw would not be there on a manually operated engine.

REDIRECT EXAMINATION

I was off duty 46 days because of that accident.

RECROSS-EXAMINATION

The set screw would not be at the same place on a manual-reverse because it is under the engine. The set screw is for the tumbling shaft. With the power-reverse, there is a set screw on each side of the engine. The tumbling shaft comes down and rests on the set screw. There is a plate on each side of it on your new type. If the engine had a manual-reverse the tumbling shaft would not rest the same way, not on that part of the frame, not in that position. It would rest on a different part of the motion. This motion work is underneath and not on this kind of an engine. I never saw this kind of an engine with a manual-reverse. I know there would not have been a set screw there on this engine with manual-reverse, because we have 821 with Baker gears which do not have that set screw with manual-reverse. This engine had a Baker gear. We had the same engines with the same gear and with manual-reverse. I can not tell what makes these set screws necessary with power reverse gear and unnecessary with hand gear. I think it is more to protect the motion work. One side does not go down as fast as the other. The engine is reversed just the same with the hand gear as with the power gear. I do not know why it is they do not have that set screw. In fact, I do not know whether if they had a hand gear on this engine they would have these set screws or not.

(Witness excused) (5739–5744).

E. R. GORMAN, superintendent of motor power and machinery for the Chicago, St. Paul, Minneapolis and Omaha Railway, living at St. Paul, Minn., testified:

I entered the service of the Chicago, St. Paul, Minneapolis and Omaha Railway Company at St. Paul, Minn., on September 1,
1901, as locomotive fireman on the western division; promoted
1637 to locomotive engineer February 1907, and worked in the capacity of locomotive engineer on the western division and the northern division of the Chicago, St. Paul, Minneapolis & Omaha and the Rocky Mountain division of the Northern Pacific Railroad from February 1907 to May 1912; traveling engineer on the northern division of the Omaha Railroad from May 1912 to December 1915; trainmaster of the northern division from December 1915 to May 1917; assistant superintendent of the western division of the Chicago, St. Paul, Minneapolis & Omaha Railroad from May 1917 to April 1919; assistant superintendent on the eastern division from April 1919 to July 1920; superintendent of motive power and machinery since that date.

In eight years' experience, five years from 1907 to 1912, inclusive, as locomotive engineer in yard, freight, and passenger service, I operated locomotives of various sizes including the 2–8–2 type, weighing 206,000 pounds on drivers, all equipped with manually operated reverse gears; and three years as traveling engineer, 1913 to 1915, inclusive, I operated engines of various sizes, including the 2–8–2 type, weighing 227,500 pounds on drivers, equipped with power reverse gears.

During the period 1907 to 1915, inclusive, I handled engines equipped with manually operated reverse gears in both single- and double-track territory controlled by manual block, and single- and double-track territory controlled by automatic block.

During the period 1913 to 1915, inclusive, I handled locomotives almost daily, many of them were on trial trips after having received the back shop repairs. I never found one engine that could not be handled safely by any engineer in the company's service nor one that required strenuous or unusual manual effort to operate.

(Motion by counsel for complainants to strike out witness's statement that he never found one engine that could not be handled safely by any engineer in the company's service, as being just a conclusion or generalization by the witness. Witness asserts that statement is based on his familiarity with all the engineers that handled the engines in question. Motion denied.)

1638 WITNESS (continuing). From 1915 to date, while in the service in the capacities of trainmaster, assistant superintendent, and superintendent of motive power and machinery, I have ridden and operated locomotives very frequently which were equipped with manual-operated and power-operated reverse gears of the Melfine, Ragonnet, Lewis, and Alco types, and have yet to see the hand-operated reverse gear that cannot be manipulated without

liability of injury or the power reverse gear that will permit of proper regulation of valve cut-off under all circumstances.

I have had experience with the Ragonnet type A and E and the Alco type E and G.

While operating a locomotive equipped with manual reverse gear, I invariably handled the reverse lever with my left hand while sitting in the usual position on the engineer's seat box. Occasionally it was necessary to brace myself while doing so, which necessitated placing the right hand against the forward side of the frame of right cab window. While in this position I had an unobstructed view which permitted me to observe signals, switch targets, order boards, whistle posts, yard-limit boards, slow-flag or fixed danger signals, any hand signals that might be given on or near the track, pedestrians, track men and vehicles or pedestrians approaching on streets or highway crossings.

On account of the length and design of the quadrant on the manually operated reverse gears, it was not necessary to look at the quadrant in order to place the reverse lever in the desired position. In fact, the quadrant cannot be seen at night time, except when the fire-box door is open. I have found that it is unnecessary to look at either the quadrant or the lever, as one soon becomes familiar with the angle at which the reverse lever stands when placed in the position which he desired to have it.

While handling a locomotive equipped with power reverse gear, I have found it necessary to either look at the quadrant while changing the position of the operating lever or use one hand on the
1639 lever and the other hand on the quadrant in order to place the reverse lever in the desired position. The limited operating reverse-lever movement and the fine wedge-shaped quadrant notches make this necessary. Experience and observation convinces me that the engineer places the manual-operating reverse lever in the desired position with less interference to observation than is possible with the power-operated reverse gears.

In switching service the reverse lever is invariably handled when the locomotive is standing still, and it is invariably moved from the forward corner to the right corner. With either the hand or power type, it would not be necessary to look at the quadrant.

Two hundred and forty-four, or 76 percent, of the locomotives, composing the equipment of the Chicago, St. Paul, Minneapolis & Omaha have piston valves. Of the two hundred and forty-seven locomotives purchased during the past 30 years, 238 have piston valves. Two small switchers purchased in 1902, five in 1905, and two in 1907 have balanced slide valves.

A total of 97 locomotives were purchased July 1, 1913, to date. Eighty-four of them were equipped with power reverse gears when built. The 10 2–8–2 type received in July 1913 and the 6 2–8–2 type received May and June 1914 were equipped with the Melline air power reverse gear. On account of unsatisfactory performance

and complaints resulting from the use of the Melline air-operated reverse gear, they were removed during the period August 1916 and December 1917, and manual-operated reverse gear substituted on the sixteen 2–8–2 type locomotives weighing 227,500 pounds on drivers. The 16 locomotives in question were operated with manual reverse gears for 7 years or until 1924. The sixteen 2–8–2 locomotives from which the Melline gears were removed, and the two 2–8–0 locomotives received during July 1913 were equipped with power reverse gears to comply with Chapter 154, Wisconsin
1640 Laws of 1923, effective January 1st, 1925. That is, after the hand gear was put back on them they were changed again to power gear to comply with the Wisconsin law.

Engineers, their representatives, or the district Federal inspector in the employ of the Bureau of Locomotive Inspection have never requested or even intimated that any engine or type of engine operated by the Chicago, St. Paul, Minneapolis & Omaha Railroad Company should be equipped with power reverse gear in lieu of the manual-operated reverse gear as a measure of safety or for the purpose of reducing the manual labor required of the engineer (5745–5752).

(Motion by counsel for complainants that the above be stricken out as heresay and argumentative denied.)

WITNESS (continuing). The chief inspector in his annual report for several years in succession, I believe up until 1928 or 1929, did make a general recommendation of this nature which was to apply to all railroads. I do not recall anything in the 1929 or 1930 reports with reference to power reverse gears. I am quite sure it was not in the 1929 report. I do not know why it was left out.

(Statement by witness that the question of substituting power reverse gears for manually operated reverse gears was never mentioned by the various committees of his road active in safety work, and that his information in this regard is based upon copies of the minutes of all safety-first meetings which he has received since becoming superintendent of motor power and machiner, ruled out.)

WITNESS (continuing). If the district inspectors had suggested to me the substitution of power reverse for manual reverse, I would have been obliged to refer the matter to the general manager or vice president. With respect to the recommendation of the chief inspector in his annual reports from 1918 to 1919, I did nothing because the general manager gets a copy same as I do.

So far as has come to my attention or knowledge the substitution of power reverse gear for hand reverse gear has never been brought up at any of the safety-first meetings until after this proceeding was instituted. Based upon my entire experience as an operating and supervisory official we have had a great deal of difficulty in
1641 maintaining a fixed point of cut-off with the power reverse gears. With a view to improving this gear we changed the quadrant, putting on a new one with eight teeth to the inch in lieu

of those with four teeth to the inch on 63 of the 86 power reverse gears on the line. We transferred four Lewis type power reverse gears from road freight to yard engines on account of our inability to make them perform satisfactorily on road engines. We have a great many reports and complaints of engines creeping and I have personally observed power reverse gears of every type we use creep. Creeping prevents proper and correct regulation of the valve travel or cut-off. When it results in excessive valve travel it means excessive fuel consumption.

I was present when Mr. Bjorkholm testified. My experience does not compare exactly with his in regard to creeping being more pronounced in the fast service than in the slower service. It is more objectionable in the fast service but it also occurs in the slow speed service, but in slow speed service the engine is invariably worked at quite a long cut-off, and the creeping is not so noticeable or so serious or so apt to do damage as when the engine is working at high speed and a very short cut-off. In an attempt to improve the performance of power reverse gears, my company has made a special effort to keep the maintenance up to the best possible condition. We have not tried out any of the special devices but the builders of the Alco gear recommended that we try out a device that they had developed to eliminate creeping on that particular gear. There have been several other devices, such as anti-creeping and locking devices, tried out in our territory, at least two other such devices. I had an opportunity to observe one of these devices. It possibly improved the condition some at times. It was an anti-friction device, and under certain conditions it apparently accomplished very little (5752–5759).

We have a total of 234 locomotives with hand reverse gears, maximum weight on drivers 163,000 pounds, and average weight on drivers 123,166 pounds. The maximum age is 44 years and the average age 25 years. The approximate cost of equipping these engines with power reverse gears would be $115,000. In addition to
1642 this the railroads' maintenance cost would be increased in excess of $10,000 per year. This estimated maintenance expense is based on our actual experience with the gears. With respect to the frequency of repairs on manual and power gears, a check of the inspection reports made at a large engine terminal, Altoona, Wis., for the month of March 1931, showed one manual-operated gear reported on each 200 engines inspected, and one power reverse gear reported for repairs on each 64 engines inspected. I do not believe it is desirable to put power reverse gears on the engines of the Omaha Company that are now equipped with hand levers, or that there is anything to be gained that would justify the expenditure. It would not increase the efficiency of the locomotives, but on the contrary would increase fuel consumption and liability of failure and accident. The introduction of power reverse gears has been responsible for a type of accident unknown prior to their applica-

tion, due to locomotives moving in the opposite direction to that indicated by the position of the reverse lever. Six of the locomotives included in the 234 have just been retired, and I am of the opinion that the rate of retirement that has prevailed during the past eight or ten years will continue, which means the retirement of ten or more engines annually. Approximately 50 of the remaining 228 locomotives are out of service at the present time. They are serviceable but in storage. There may be two or three undergoing repairs.

Those Mikado locomotives that were originally equipped with Melline gears which were removed and hand levers placed on them would weigh around 227,000 pounds on the drivers. They were operated with the hand levers an average of approximately seven years. They were used in through freight service and occasionally in a little way freight. The hand levers were scrapped. During the time the engines were equipped with hand levers I handled them only occasionally. At that time I was trainmaster and assistant superintendent. I have no knowledge of any complaints at any time with respect to the handling of those engines with hand levers.

1643 I did not find them difficult to handle at all. I have had very little difficulty with dry valves. In the event of a valve becoming dry I always found that the situation could be taken care of promptly by partially closing the throttle, thus reducing the pressure in steam chest or valve chamber considerably below that of the boiler, to permit the oil to flow through the oil pipe to the steam chest or valve chamber. That is, providing of course that there was oil in the lubricator, and it was operating. I have no recollection of not being able to move a reverse lever at any time I found it desirable or necessary. I have no recollection of ever having any difficulty handling the reverse lever when the valves were dry. I do not feel that safety of operation of the locomotives on our line that are now equipped with hand levers would be in any way promoted by substituting power reverse gears.

CROSS-EXAMINATION

I do not think the application of power reverse would prevent any accidents similar to the ones which we have had with manual gear. We have had two cases that I recall of men having bones broken in their feet by the lever coming down. The same injury would be possible with power reverse if a man put his foot between the end of the quadrant and the lever. I do not recall that I have ever observed anyone doing that on a power reversed engine. I see no necessity for his doing it nor do I see any necessity for his so doing with the hand lever. I do not recall a case on our record where men have been injured with manual reverse levers caused by a failure of the manual reverse mechanism. With respect to the case of engineer L. M. Page, who was injured in July 1929, while hooking the reverse lever up on a manually reversed engine and the lever went down to full forward position, catching his foot, and it

was found that various parts of the mechanism were broken off and missing, the inspection developed that this condition existed after the engine ran 100 miles or more following the accident.
1644 I think no one is in a position to say that those parts were missing when the accident occurred. I do not have any knowledge that they were not missing. That accident would have happened with power reverse if the engineer had his foot between the reversed lever and the end of the quadrant frame, but I never heard of such a thing on a power reversed engine (5759–5765).

I have had a stop pin in the quadrant improperly located on the engine. That is not likely to lead to an accident if the lever goes to the corner, if the engineer puts his foot where it belongs. If the absence of improper location would permit the lever to go far enough, there is a possibility of catching his hand on the boiler. I believe there was one such accident on our road, resulting from the failure of a balance ring on a slide valve engine. The failure of a balance ring may possibly produce a condition which will pull the lever away from the engineer if he is handling it. I do not think it would cause the lever to jump the quadrant and go to the corner. The accident of September 4, 1922, reported to the Bureau of Locomotive Inspection, was, as I remember it, that he attempted to move the lever. It is not my recollection that it jumped out of the quadrant. My statement that I have yet to see a hand lever that cannot be operated without liability of injury was based on my experience and observation on a locomotive. I still say that I can operate a hand lever without being injured even in cases where various parts of the reverse gear fail. If the counterbalance spring broke while I was handling the lever that would not make difference enough to take the lever out of my control. I do not understand that a spring hanger would have any material affect on the reverse lever, even though it did break. It would probably bind or force the reach rod up against the running board or the side of the boiler and prevent further movement. I do not understand that there would be any liability of injury while handling the lever at the time that obstruction and bending of the reach rod occurred. It would
1645 probably prevent the moving of the lever by throwing the reach rod up against the running board, or something, but it would not jerk the lever out of my hand. I don't think it would give me any jerk if I were exerting force against that when it happened. With respect to accident reports by my road, I do not recall having made a statement that there was no liability of injury with manual reverse. There is liability of injury to other men, but it would not occur to me.

The Mikado engines previously mentioned are now equipped with power reverse in compliance with the Wisconsin law. There is no reason why they could not be equipped with manual reverse if we wanted it. I think about 60 or 90 days ago was the first advice I got that the Wisconsin power reverse gear law was not still binding. I

was a witness in the cab curtain case in 1927. I knew the Wisconsin law pertaining to cab curtains had been declared unconstitutional. I did not ask anybody whether we could take them off then or not. They have not been taken off. The figures which I previously gave with respect to maintenance cost of power reverse are based on some engines which went through the shop recently (5765–5770).

1646 REDIRECT EXAMINATION

(Question as to whether or not there are any other cases of defects in reversing gears on the Omaha line which were reported to or investigated by the Bureau of Locomotive Inspection other than the particular case referred to on cross-examination, objected to by counsel for complainants on the ground that witness should not be permitted to testify what is in the Bureau's reports, or whether his road made any reports, because he is not the man who made them.)

WITNESS (continuing, answering question by examiner as to how he would have such knowledge). Either by having remembered reporting the affair to the chief inspector or from having read the annual report.

(Examiner rules that the question is too broad in view of witness's qualifications.)

(Question by counsel for defendants as to whether or not in the last 11 years there have been any other cases of defects in connection with hand reversing mechanism in any way resulting in personal injury to anyone, in addition to the case referred to on cross-examination where a stop pin was improperly located in the quadrant, objected to by counsel for complainants on the ground, among others, that witness is not qualified. Examiner rules the question is entirely too broad.)

WITNESS (continuing, in answer to question by his counsel). I do not know whether or not any other defects on hand-reversing mechanism have resulted in any injury on the Omaha line in the last 11 years. None have come to my attention.

I have made a check of the annual reports of the chief inspector and the Federal Boiler Inspector back to and including 1920 to determine whether there is any record of such defects on the Omaha line other than the one which has been referred to.

(Following discussion between examiner and counsel for parties with respect to propriety of this witness putting in testimony based on such annual reports.)

WITNESS (continues). I have a statement showing the va-
1647 rious defects reported on all the locomotives of the Omaha line during that 11-year period, including this one reversing lever case.

(Statement marked for identification as "Exhibit No. 79.")

(Question as to whether statement shows all the accidents that were investigated by Bureau during 11-year period concerning defects occurring on the Omaha line, as disclosed by the annual reports

of the Chief Inspector, objected to by counsel for complainants on the ground that the reports themselves would be the best evidence. Upon admission by counsel for defendants that statement is offered merely to indicate what the reports show, examiner sustains objection.) (5770–5779.)

RE-CROSS-EXAMINATION

I do not recall a question by Mr. Morehouse (counsel for defendants) on the subject of the advisability of replacing manual levers with power levers, or my answer that to do such would increase the fuel consumption. The replacing of the hand reverse gears with power levers was done to comply with the Wisconsin law. He did ask me whether I saw anything as to the desirability of equipping these remaining 234 with powwer reverse gears, and in answer to that question I stated that it would be undesirable to equip the remaining locomotives with the power reverse because it would increase fuel consumption. That is my opinion and is based on the fact that it is impossible to control valve travel and steam distribution at all times with any type of power reverse gear that I know of. I have never made a test of a locomotive equipped with a manual lever, and then equipped with a modern power reverse, under a similar load and operating conditions, to find out what effect it had on fuel consumption. My opinion is not based only on the performance of a power reverse in good condition and one that is creeping, but also the fact that you cannot place or regulate the cut-off where it should be with a power reverse at all times, irrespective of its creeping. I would hesitate to express the percentage of
1648 times but it occurs frequently. In addition to creeping, the failure of the gear to respond to each notch of the quadrant will interfere with regulating the cut-off. It is due to just a trifle of slack in the various connections, and the great difference in radius between the lever movement and the control valve movement. If the power reverse responded to the movement of the lever the adjustments would not be finer than those on the usual manual reverse. In making this statement I am giving consideration to the quadrants used on our railroad. The arc of the quadrant on the manual reverse is materially different in size from that on the power reverse. The manual is larger. The quadrant of the manually-operated gear is longer than the power. I would not say there was any great difference in the portion of the circle that it takes up. There are more notches in the manual quadrant used by us than there are in the power quadrants received from the manufacturers. At the present time on our road there are approximately the same number of notches in the manual quadrant as in the power quadrant. We have made no tests of fuel consumption on an engine equipped with a manual bar as compared with the same engine equipped with a power reverse (5779–5784).

REDIRECT EXAMINATION

I have observed a difference in fuel consumption when there was creeping and when there was not. I have also observed the effect of creeping upon the fire and the performance of the locomotive.

We put the power reverse gear on the three new Pacifics purchased in 1930 because we were limited on the total length of the locomotives. It was necessary that we get a passenger engine with the very maximum capacity within a certain total wheel base. There was not room in the type of cab to put a manually-operated reverse gear. The distance from the boiler head to the back of the cab, as I recall
1649 it, is but 34 inches and the available space in the cab is all taken up with other equipment that had to be placed there. In addition to that they are a very wide fire-box engine. With respect to the 8-wheel switchers which we got in September 1928, it was desirable to put power on them for practically the same reason. While their wheel base is not so great, they frequently work in yards where facilities are shorter, turntables are shorter, and they are hand-fired engines, and it was desirable to get the coal just as close as we could get it to the fire-box door to avoid unnecessary handling of fuel. With respect to the Mikados which we got in 1926, they operate out of Minneapolis and are obliged to turn at 3 different points on an 80-turntable. And the same thing prevails there which did in connection with the engines purchased in 1930. In this particular case I would say that economy has been brought about through the use of close clearances and the power gear, and that overcomes the objectionable features of the power gear from the dollars and cents standpoint.

(Witness excused.) (5784–5786).

O. E. WARD, superintendent of motive power of the Burlington Lines East, residing at Chicago, Ill., testified:

I have been with the Burlington Railroad since 1902, 7 years as locomotive fireman, 8 years as locomotive engineer, then in various capacities as road foreman, airbrake inspector, master mechanic, and for the last 5 years superintendent of motive power.

The first application of power reverse gears on Burlington locomotives was in 1909, when six Mallet engines were purchased, equipped with power reverse gears. Power reverse gears were considered desirable on these engines for the reason that there were two sets of valve motion to be handled. Although it would have been
1650 physically possible to have designed a hand reverse gear which could have been used to reverse Mallet engines with ease, this would have been mechanically awkward, if not entirely impracticable, on account of lack of room to arrange for increased leverage and counterbalancing, which would have been required on account of the two sets of valve gear. The six engines had slide valves. The power reverse gears on these locomotives did not prove satisfactory and had to be replaced by Ragonnet gears.

In 1910 the Burlington purchased ten more Mallet engines, which were equipped with power reverse gears.

In 1912, the Burlington equipped one hundred new heavy Mikado engines and give new Santa Fe type engines with power reverse gears. Since that time power reverse gears have been specified by the Burlington on new locomotives, so that, on January 1st, 1932, we expect to have a total ownership of 1,375 engines, of which 578 are equipped with power reverse gears. As a number of the locomotives not so equipped are not in active service, the percentage of Burlington locomotives in active operation equipped with power reverse gears is greater than the figures just given indicate.

Several reasons have contributed to the fact that the Burlington has not equipped all its locomotives with power reverse gears. Chief among the reasons are: First, the initial cost; second, the cost of maintenance; third, the fact that power reverse gears at the present time are far from perfect; fourth, the fact that the locomotives which are not equipped are being retired as rapidly as is possible; fifth, the fact that the locomotives which are not equipped are generally small locomotives; sixth (and perhaps most important), the fact that while possibly a convenience on some of these locomotives, power reverse gears on the Burlington locomotives which are not so equipped are not necessary either from the standpoint of efficient operation or of safety.

1651 Taking these matters up in the order just given, it would cost the Burlington approximately $418.00 per engine, or a total of $324,368.00 to equip all locomotives with power reverse gears, not so equipped as of January 1st, 1932, excluding locomotives set aside to be retired. This includes relocating air pumps, main reservoirs, etc., on the engines where necessary to make room for the power reverse gear. This is a very substantial sum of money and, from an operating standpoint, should be spent only if there is something to justify it.

There is nothing to justify the expenditure from the standpoint of maintenance. On the contrary, it has been found that cost of running repair maintenance at terminals, of power reverse gears is about 200% greater than maintenance cost of hand reverse gears. When engines receive classified repairs the average spent to condition power reverse gears is $28.63 per engine, while the average spent on hand reverse levers in connection with classified repairs is only $2.93 per engine. On this basis the additional cost for maintenance, both running and classified repairs, if power gears were applied to the remaining engines not now equipped, would be $15,706.69 annually.

From a mechanical standpoint, the power reverse gears are still in the development stage, and are not as efficient as the hand reverse levers, as I shall describe later. Until greater improvements have been made in the power reverse gears, it does not appear from an operating or safety standpoint, the there is any justification for substituting them for the hand reverse levers more rapidly than we are now doing.

The fourth point to be considered is the fact that the newer locomotives are equipped with power reverse gears, while the older ones are being retired with a fair degree of rapidity. As of January 1st, 1932, the Burlington will have 578 locomotives equipped with
1652 power reverse gears and 797 not so equipped. Of the latter number 74 are not in active use; 21 of the 74 are now set aside to be retired; the others still have a few months' service in them and will be retired as soon as this service is used up.

For convenience, I shall discuss first the switch engines, then the road freight locomotives and then the passenger locomotives.

The Burlington has 389 switch engines. Of these 110 are equipped with power reverse gears. Only 77 of the switch engines weighing as much as 165,000 pounds on the drivers, are not equipped with power reverse gears. 28 of the 77 will be retired when due for general repairs. 33 of the 77 will be equipped with power reverse gears being removed from heavy Mikados now being retired. This leaves but 16 engines above 165,000 pounds on drivers that will be perpetuated as hand reverse engines.

In a short time, only a few of the lighter classes of switch engines will be in service. They will be assigned to jobs where the work is light and there is much less reversing to be done than occurs in main line yards. In view of the light work to be performed and the greater difficulty in maintaining the switch engines at small points than at the large terminals where skilled help and all necessary machinery are readily available, it is not believed necessary or desirable to equip these small engines with power reverse gears.

The Burlington has 624 heavy road freight engines, 413 of which are equipped with power reverse gears. That is, all road freight engines above 152,000 pounds on the drivers are now equipped with power reverse gears, except 17 light Mikado locomotives, which are gradually being placed in switching service.

Road freight engines of 152,000 or less pounds on the drivers are being retired rapidly. The few remaining ones will
1653 be assigned to branch line service where the work is comparatively light.

We also have 144 light road freight locomotives, ranging from 57,070 pounds to 152,000 pounds on the drivers not equipped with power reverse gears. These have the piston valves although equipped with Stevenson link motion, except for engines of the A–2, K–1, and K–2 types. As the latter types weigh only 57,070, 92,900, and 100,700 pounds on the drivers, respectively, we consider them too small to be equipped with power reverse gear. I have handled these various engines personally a great many times and do not feel any need for a power reverse gear on them.

The Burlington has 218 passenger engines, of which 55 are equipped with power reverse gears. All passenger locomotives above 165,000 pounds on the drivers are so equipped. As to the remaining 163 locomotives weighing 165,000 pounds or less on the drivers which are

in passenger service, practically all of them have piston valves and the Walschaert valve gear. I have personally operated these engines many times and don't feel that there is any necessity for power reverse gears. The reverse lever can be adjusted readily without the engineer having to take his attention from the track. There are a few of the K–1 and K–2 engines in passenger service, but as I stated earlier, they are very small engines. They are on light runs of two or three cars.

Locomotives are being developed and improved constantly. It is impossible, of course, each time an improvement is made to replace all power at once, but we endeavor to install new locomotives as rapidly as the money is available and sound-operating practices permit. The new locomotives are equipped with power reverse gears, and they replace and supersede the older locomotives which
1654 are not so equipped. On account of their superior efficiency, and quite frequently their greater size, the new locomotives are used for the heaviest work. In other words, the locomotives not equipped with power reverse gears are not only being reduced in number, but they are being shifted to the lighter work.

In the meantime, I know from my own experience that there is no necessity, as distinguished from mere convenience, for equipping the remaining locomotives with power reverse gears. As these locomotives have been operated for a substantial portion of their service lives and will be retired in the ordinary course of business under our replacement program, we do not feel that we would be justified in expending large sums to equip them with power reverse gears.

I have developed already the fact that the remaining locomotives which are not equipped with power reverse gears are, almost entirely, the smaller locomotives.

The sixth point is that power reverse gears on locomotives not so equipped at present are not necessary from the standpoint of efficient operation or of safety. I have said already that the cost of maintaining the power reverse gears is greater than that of maintaining the hand reverse levers, and that there is some difficulty in maintaining the power gears on engines which do not operate into and out of large terminals. In addition to these features there is a tendency for power reverse gears to "creep." That is, the device fails to maintain the valves at a desired fixed point of adjustment, with the result that more or less steam is admitted to the cylinders than is necessary for the maximum of efficient operation, causing the use of more fuel than otherwise would be required.

Moreover, with the manual or hand reverse lever, an engineer keeps in more direct contact with the condition of his locomotive and the manner in which it is operating. This advantage is
1655 largely lost with the power reverse gear.

It is, of course, a source of regret that there are any accidents in connection with the use of hand reverse levers. I do not wish to be understood as depreciating in any way the desirability

of making conditions as safe as possible. I have operated the Burlington engines on numerous occasions, however, and there is no necessity for an engineer to place himself in position where he could be injured by the lever or its related parts. While there has been some testimony to the effect that engines just received from the shop are hard to handle, it is obvious that, even if this condition exists for a day or two, the percentage of engines in this condition is small as compared with the number that operate easily (5787–5795).

I have a statement showing the number of accidents attributed to the handling of the reverse gears which occurred on the Burlington during the years 1928 and 1929 and which is based upon the reports made to the Commission for those years. I believe the statement was submitted as an exhibit in this hearing. (By examiner: 1929 and 1930.) I have it for 1928 and 1929 but not for 1930.

(Counsel for complainants object to any statement about witness's version of those accidents and particularly for the year 1928 when there is nothing in the record. Objection sustained.)

WITNESS (continuing). It must be borne in mind that the power reverse gear is not free from defects. It is a part of my duties to keep in close touch with the performance of Burlington locomotives and to investigate and keep advised as to any failure to perform properly. As an example of one frequent source of trouble with power reverse gears, a failure of air pressure makes it impossible to operate the gear. As an illustration of these accidents the following are taken from our records:

(Counsel for complainants object to any testimony based
1656 upon said records upon the ground that it is hearsay and no one is present to be cross-examined about what the records show. Objection sustained upon admission by witness that he personally knows about these accidents only through reports reaching his office.)

WITNESS (continuing). In conclusion I wish to say that it is the constant effort of the Burlington to maintain in good condition the locomotives already in use; and to replace old locomotives by new ones of the best type as rapidly as is consistent with economy of operation.

These new locomotives have been equipped with power reverse gears because of the wide fire-box and wide boiler head practically filling up the cab and making it impractical to apply a hand reverse lever that would not be awkward. We purchased some heavy Pacific type locomotives with power reverse gears on them and they were assigned on a long hard run. Being hand fired, both the engineman and the fireman complained of the power reverse gears' erratic action. To try to get away from that complaint we took three of those engines and equipped them with hand reverse gears, but because of the conditions I have mentioned the reverse lever when pulled in the backwward motion would strike the engineman in the chest, and if in the extreme back motion he could not get to the window readily to

take signals. So we took off the hand gears and put the power reverse gears back on. The situation on the larger locomotives is more aggravated. Since we have gone to fire-boxes 102 inches wide it is just out of the question.

If the Commission should order the power gears off, the carriers would be in a rather serious situation. For example, in the application of the hand reverse lever to our later power, there are two things that would confront us. We would have to set the reverse
1657 lever out so far, we would have to set it next to the outside wall of the cab if we left the cab as at present. The result would be that the reverse lever hooked up near center or in back motion it would interfere with the engineman going to the window to see out. The only other way to do it would be to set the cab back and then mount your reverse lever to the level of the engineman and to the rear of the boiler head. With our present locomotives that would make them too long for practically all the turntables we have. I would not regard either of those means as practical. So with those engines about the only thing to do is to go ahead with the power reverse gear as a practical matter. As to the three Pacifics which I spoke of, when we mounted the hand lever on them the reach rod was brought back along outside of the boiler head and the lever was mounted directly in line with it. There were no offsets. In the forward motion it swung up alongside of the boiler. When it was in extreme backward motion it came up against the engineer's chest. That could not have been remedied by moving the seat box back so that he would have been in the clear, because the seat box was in the extreme back corner of the cab. That particular method of mounting the lever would have been objectionable to a certain extent even if we had the link (length?) to get the seat box back. Mounting the lever where it would not interfere with the engineman on the seat, particularly when in backward motion, then it would have been so far away from him that it would have been necessary in adjusting it when running forward to get up and make a step in getting to it. It would have been entirely out of reach from the seat. The space between the lever and the outside wall of the cab would run just about 10 inches.

These engines had the Ragonnet power-reverse when we first got them. When they were changed back we put the Ragonnet back on. Since that time we found it necessary to have some
1658 additional gears so we took the Ragonnet off or those engines and put on Barcos. The Barco has more or less of an erratic action, not so much as creeping but it is pumping after an adjustment is made of the lever. By that I mean it will not respond to a change of one notch on the quadrant. The result is that you will probably move the lever three notches to get it to respond and then it will move four or five times back and forth before it finally comes to rest. Personally, I do not believe that the application of the power reverse gears to locomotives on our line now equipped with manual reversing gears would promote safety (5795–5803).

CROSS-EXAMINATION

When we were designing these new locomotives that were purchased equipped with power-reverse we did not take into consideration whether the power-reverse was an unsafe device. It was a necessity on the engine. We did not consider it an unsafe device at that time. At the present time we consider it an unsafe device in this way: Our experience has been that when we do have an injury with a power reverse gear it is a much more serious injury, as indicated by the evidence presented at this hearing. Even if we had thought we would have serious accidents as a result of installing power reverse gears, we would have put them on. There was no other way to design the engine we wanted. We could not have made the fire box narrower and get the capacity we needed. There were no considerations that the power-reverse would handle better and be more economical than the hand-reverse. I have heard of such considerations being urged on behalf of the power-reverse. I attend conventions of railroad men and mechanical men and I attend the road foremen's conventions from time to time. I have not attended all of the latter conventions for the last five years.
1659 I can not tell you the ones I have attended. I usually go over one afternoon, say, and look at the exhibits, but so far as sitting through the convention I have never sat through the entire convention in the last seven or eight years. From reading the minutes of their meetings I know that the subject of power-reverse has come before that body.

We have equipped some engines with power reverse that were formerly manually reversed. They were light Mikado locomotives designed for road service. We assigned them to yard service. The sweep of the reverse lever was greater than on any freight engine we had, and they were inconvenient and awkward for yard work so we bought six power reverse gears and applied them. The reason they were awkward for use in yard work and not in road work is that on the road there is very little switching to be done. Most of the work was done with the reverse lever forward. In the yard work it was to the rear 50 percent of the time. We had had no complaint about their being awkward in road service. There were no other classes of engines other than these which were converted from manual to power reverse. Our engines receive light classified repairs once a year on the average. The amount of $28.63 previously stated as the average spent to condition the power reverse is based upon two years' service. On our latest power the width of the cab between the boiler and the inside of the cab on the engineer's side is about 14 or 15 inches, that is, in the engines on which we put this gear. The distance between the side of the boiler and the inside of the cab in front of the engineer's seat at the deck is about eight inches. The distance gets wider between the wall of the cab and the boiler as it goes down. We could extend the cab forward upon the boiler and

then we could put a manual reverse on in front of the engineer's seat box. The objection to that would be that you would have to set it so far ahead in order to clear him when it was in back-
1660 ward motion that when it is away from backward motion it is entirely too far, and I think he could hardly reach it in the extreme forward motion. The clearance between the cab and the boiler head would make it very difficult for him to reach the lever in extreme forward motion if placed alongside of the boiler. It could be done but it is not practical and I don't think it could be handled successfully (5803–5810).

We discovered that we could not apply manual reverse bars on these locomotives when we adopted the extremely wide fire box. That was not just recently, we have had that class of engine since 1912. I have never seen a manual reverse on that type of engine except the three we tried and took off for the reason that when the reverse lever was in back motion it would strike the engineer in the breast. We could have moved the lever ahead but then, as I said, he would have to get up and walk to it. That cannot be done from a mechanical standpoint in a successful way. I do not say it is entirely impossible, but for a man of my size if you put the reverse lever as you have suggested, I could not reach it in forward motion. The entire quadrant would be in this 8-inch space. For a man to get the lever when it is in forward motion, he would have to be on top of the quadrant. When it was so arranged that it hit him in the breast, he could reach up there but not readily. He reached it and he handled the engine. It so happened he could do it in the service she was in—passenger service. Had it been in freight or switching service he could not. The fact that it hit the engineer in the breast was one of the reasons for its removal. We could have moved it ahead a little and eliminated that feature but we would have developed others, such as the narrowness between the cab and the boiler head. It would not get any narrower but we would have to go farther into it, about 18 inches. He had to get out of the way in order to get it in back motion. It would not hit him if he stepped to one side but he had to step away from the
1661 window. I did not develop the idea after this case started that we could not equip those engines with manual gears. We tried that before this case came up. The application was made in 1924 to these three engines. The engineer, in getting the lever in the front corner or in hooking it up, would be directly over the quadrant. That is very undesirable, if the reverse lever should fly back, as it has been testified here. That was one of our considerations. Of course, at that time I had not heard this testimony.

The unsafe condition created by the power reverse gear does not exist so much to the man in the cab as to the one working around the locomotive. The condition around the terminal is more unsafe with the power gear than with the hand gear. I don't think there is any difference away from the terminal while the engine

is being operated. However, I hope the Commission does not say that even on new locomotives we cannot put power reverse gear on them. On the Barco gear, or when we develop a gear along the line of the Barco—the Barco is not perfect—where we do not depend upon the air in the cylinder to hold the valve motion fixed after the engine is dead, we are going to get a safer gear. That sort of gear is in contemplation now and we plan to use it when we build new locomotives.

REDIRECT EXAMINATION

We have not tried out this new proposed gear. We have viewed some of the details with the manufacturer. I have no means of knowing what the result will be; none has been tried yet. I have taken into consideration the possibilities of accidents between the two classes of gears where enginemen are oiling around, that is, outside the terminals on the road. The power gear, when a man is oiling around, is more apt to cause a serious injury than the hand lever. That is true when you have air on the engine and
1662 whether somebody moves it or in case it moves without somebody operating the lever. I have taken into consideration the opportunities for accidents between the two classes of gears in cases of light engines, in case of air failures on light engines on descending grades. Under those conditions the hand reverse lever is the safer. However, in designing the modern locomotive we have to meet those conditions, and sometimes one article will work out and sometimes another. In designing the modern day locomotive I do not see how we could design it without a power gear. In answer to the question as to whether the Commission should permit the construction of the more dangerous vehicle simply because it does not cost so much in dollars and cents to operate per ton mile, my thought was that it is the best we can do on modern power. But why issue an order to require us to put those on engines that can be safely operated with hand power? From the standpoint of safety, I would say that there is not enough difference between the power reverse gear and the hand reverse gear for the Commission to require us to put the hand gear on the large locomotives or require us to build smaller locomotives with hand reverse (5810–5819).

(Witness excused.)

1663 W. P. CUNNINGHAM, superintendent of motive power with the Monongahela Railroad Company, testified:

I have been superintendent of motive power for ten years. Prior to coming to the Monongahela Railroad I started to work in the shops of the Pittsburgh & Lake Erie Railroad in 1903. I worked on through the shops as an apprentice, helper, machinist, foreman, general foreman, and I left the service of the Pittsburgh & Lake Erie in 1921 to take my present position. I have never had any actual experience in running an engine. In cases of accidents in-

volving engines and engine crews reports are made direct to my office and I have on file at the present time the original reports made up by the parties involved in such accidents. These reports have been on file since about the middle of 1909. In addition to these I maintain in my office a roster of engines. In addition to showing the sen'ority, this roster also shows the number of the engineer. There is also a record kept of the locomotive miles made by all engineers in service. At the end of each run the engineer is required to fill in a regular printed form of work report respecting the condition of his engine and which shows the defects the engine developed during the run. The original work reports relating to the condition of the engines are kept in the general foreman's office, which is under my supervision. With regard to accidents I have the work reports with me. The balance are on file in the office.

(Counsel presents statement entitled "Statistics relating to locomotives in service on the Monongahela Railroad, January 1, 1931, and directs witness to describe same.)

WITNESS (continuing). This statement shows the engine numbers, the number of engines of each type, the type of engine, the
1664 weight on drivers, the type of valve gear, the type of valve, whether slide or piston, whether superheated or saturated, and the year built; also whether equipped with hand lever or power reverse gear. I have personal knowledge of the facts contained in this statement, which was prepared under my direction. (Statement received as defendants' exhibit no. 80.)

(Counsel presents statement entitled "Accidents resulting from the use of hand reverse gear on locomotives, January 1, 1919, to December 31, 1930, compared with number of engineers on roster each year" and directs witness to describe same.)

WITNESS (continuing). This statement shows by years the number of engineers, the number of accidents, the time lost in days, and compensation paid for that period. This statement was prepared under my direction from the original records.

(Above statement offered in evidence by counsel for defendants, but its receipt objected to by counsel for complainants on the grounds that it is based on hearsay and that there is no opportunity to cross examine as to what happened to the engineers or anything else. Counsel for defendants states it is not intended to convey information relative to accidents, but only as to the relative frequency of accidents during those years. Witness states he did not see the accidents and obtained the information solely from the accident reports. Objection sustained. Exception to ruling noted by counsel for defendants.)

(Counsel presents statement entitled "Locomotive miles made by locomotives equipped with power reverse gears compared with locomotives equipped with hand reverse gears, January 1, 1919, to December 31, 1931.")

WITNESS (continuing). This statement is self-explanatory and was prepared under my supervision from the original records. (Statement received in evidence as defendants' exhibit no. 81.)

(Counsel presents statement entitled "Defects reported in power and hand reverse gears on locomotives for the year 1930" and directs witness to describe same.)

1665 WITNESS (continuing). This statement shows by months the number of locomotives in service equipped with power reverse, and with hand reverse, the number of defects reported on locomotives equipped with either and the relative frequency of the reported defects with each, and was prepared under my supervision from the records in my office.

(Counsel for defendants offers statement in evidence which is objected to by counsel for complainants on the ground that witness does not know anything about the defects from his own experience or that he has ever seen any of them and that, therefore, it is impossible to cross-examine witness upon the facts. Statement received and marked "Defendants' Exhibit No. 82" with the understanding that complainants are to be given access to the original work reports.)

(Counsel presents statement entitled "Defects in power reverse gears reported in the year 1930" and "Defects in hand gears reported during 1930.")

WITNESS (continuing). These statements were prepared under my supervision. All of the work reports for the year 1930 were examined, and these statements contain the summary of all work reports that showed defects in either hand reverse or power reverse during that year.

(Receipt of above statements in evidence objected to by counsel for complainants on the grounds that witness has been asked to draw a conclusion from the work reports in his possession at the home office, and has had somebody make this compilation under his direction and the conclusion is as to whether it is a reverse gear defect or not.)

(Above statements received in evidence as defendants' exhibit no. 83.)

We have 69 locomotives. I believe 31 are out of service right now, stored. I cannot give them by engine numbers, but there is a total of 31 stored out of the 69. Of that 31, nine are equipped with power reverse and 22 with hand reverse (5819–5831).

1666 CROSS-EXAMINATION

In the month of January we had 14 locomotives in service equipped with power reverse gears. We had 16 Mikado engines, 10 equipped with Lewis, and 6 with Ragonnet power reverse gears. Two of them were stored. I do not know whether the latter were equipped with Lewis or Ragonnet gears. Those are the two types of power

reverse gears that we have. The manual reverse are all of the bar type. I cannot tell you how many parts there are on a Ragonnet type of power reverse which are subject to strain or susceptible to being reported for defects. If I had a chart I could tell you, but I do not want to make a guess. There are 9 or 10 parts in the manual reverse lever that are subject to wear—pins, springs, dogs, and quadrants.

I heard a witness make a statement this morning to the effect that on one of the types of power reverse there are 50 invisible parts and 75 parts altogether, but I don't remember what gear he referred to. There is a lot of difference in the two or three different types of gears as to the number of parts. There is a total of 50 on the Ragonnet that might either wear, come loose, or be lost—cotters, nuts, and all told. The number of parts of the Lewis and Ragonnet are about the same. The Precision has the most parts of any. We do not have any, but from what I have seen of them I think the Precision has the most parts. We have had more defects on the Lewis than on the Ragonnet, two to one as compared with the Ragonnet. We have altered our Lewis gear. There are five or six times as many parts to the power reverse as there are to the manual reverse that are subject to becoming defective. In December the relative frequency that we had was 6.3 power-reverse defects to one with hand reverse and throughout the year the relative frequency was 28.1 with power reverse to one defect with hand reverse.

1667 With respect to engine no. 171, which was reported successively on February 5, 6, and 7, 1930, for reverse gear creeping, I cannot tell about the movement of that locomotive on those three days unless I look up the records. The three reports are filed at the same place and worked on by the same shop. The work slip attached to the original report for February 5 on that locomotive shows "Reverse bar creeping. O.K." and signed "F. L. Thompson" indicates that Machinist Thompson has done what he could to correct that condition, which in that type of gear it is impossible to do. He can examine the gear and the rotary valve and if he does not find any leakage or anything there, all he can do is to oil it and look at the packing and go over it in a general way. But with the type of gear, the Lewis, on that engine we have altered only three sets of that gear ourselves to try to make some improvement to stop this creeping and we cannot do it. On that date there was done all that was possible to be done with the construction of the gear. With respect to the report for that engine on February 6 that reads "Reverse bar creeping very bad" and the workman's report attached thereto reading "Reverse gear creeping. Take out lost motion in control valve handle and all necessary parts. Serviceable." and which was initialed as having been inspected by the general air-brake inspector, J. D. Flinner. This indicates to me that when Mr. Flinner was called in that he himself had gone over this and

he may have renewed the control valve. It does not say that here, but he may have done it. It was not left up to the workman. The report on the sixth indicates that the control valve had lost motion. When that is indicated it is repaired if in the judgment of the man it is necessary. The item "air reverse control valve leaking bad" was not entered by the workman, that is the foreman's.

1668 (Counsel for complainants refers to engineer's work report dated February 7, which reads "air reverse creeping bad" and also "air reverse control valve leaking bad" and infers that apparently the lost motion was not taken up on the day before.)

WITNESS (continuing, in reply to above inference by counsel). Lost motion wouldn't have anything to do with the control valve leak. The control valve leak is a leak in the seat. The lost motion hasn't anything to do with that. Taking out the lost motion doesn't have anything to do with the control valve leaking. The control valve is the seat the air leaks by. The lost motion is in the pins and the lever itself. They could have completed the repairs properly on the sixth and had the report made on the seventh that was made in this case. It may have happened the next trip.

(Witness excused) (5831–5840).

At this point counsel for defendants (Mr. Thom, Jr.) introduced as exhibits various form T reports in relation to accidents mentioned in the testimony of witnesses Crystal, Persch, Ingram, Arnold, Landers, Von Bergen, Cooksey, and Ryan which, without objection, were received and marked as "Defendants' Exhibits Nos. 84 to 91," respectively.

Counsel for defendants (Mr. Morehouse) presents as an exhibit form T report with reference to injury to Charles Adleman in January 1928 which accident was not testified to by any witness, Mr. Adleman being dead. Counsel for complainants object to receipt of this and like reports as to which there is no opportunity for cross examination. Objection sustained as to report concerning Mr. Adleman, and similar reports concerning which no witnesses testified. Counsel Morehouse notes an exception to examiner's ruling (5841–5848).

1669 A. I. CILISKE, employed by the American Railway Association and residing at Chicago. Ill., testified:

I am employed by the American Railway Association as mechanical inspector. We conduct special investigations covering violations of rules of interchange. A request was sent out from our Chicago office to the various class I railroads in this country for information as to the cost of applying power reverse gears and I have made a compilation of the replies to those requests. I personally made that compilation. Statement offered and received as defendants' exhibit no. 92.

Upon suggestion by examiner, counsel for defendants (Mr. Thom, Jr.) expresses desire to subsequently file a tabulation showing the information contained in exhibit no. 92 by roads.

(No cross-examination.) Witness excused.

Counsel for defendants (Mr. Morehouse) reads into the record rule no. 157 of the Code of Rules and Instructions for inspection and testing of steam locomotives and tenders, being the code of rules in force at present under the so-called locomotive inspection law, as follows:

"157. Reversing gears.—Reversing gears, reverse levers, and quadrants shall be maintained in a safe and suitable condition for service. Reverse lever latch shall be so arranged that it can be easily disengaged, and provided with a spring which will keep it firmly seated in the quadrant. Proper counterbalance shall be provided for the valve gear" (5848–5853).

1670 K. CARTWRIGHT, assistant mechanical engineer for the New York, New Haven & Hartford Railroad, living at New Haven, Conn., testified:

I have held the position of mechanical engineer since June 1924. I started in the test department of the New Haven in June 1914, having charge of running road tests of locomotives. I had the title of assistant engineer of tests. I continued in that department until the war, in 1918, and I left at that time and came back in 1920 to the same position. Then during the strike in 1922 I had charge of locomotive repairs at the Fore River plant of the Bethlehem Shipbuilding Company, and in 1923 I was made chief mechanical inspector in charge of locomotive inspection of the system, and then in 1924 I was made assistant mechanical engineer, and I have continued in that capacity up to date. I graduated from the Massachusetts Institute of Technology in 1912. Since 1924 the design of locomotives and the application of various appliances and appurtenances thereto has been under my supervision.

I am familiar with the various classes of power on the New York, New Haven & Hartford Railroad. Neither the weight of the locomotive on the drivers nor its weight over-all has any effect upon the amount of force required to operate the reversing gear. The force required to operate the reversing gear depends upon three or four factors, none of which is influenced by the weight on drivers—the type, the size of the valve itself, and the type and design of the valve gear. The valve gear may be exactly the same gear, the same weight and everything on locomotives that vary widely in weight on drivers. We have engines equipped with Baker valve gear in about five classes. These engines run from 141,000 to 298,350 pounds on drivers and take the same valve gear. We can take a part off one

1671 and put it on another; it is interchangeable. Considering such parts as the reach rod and reverse shaft arm and parts like that which are moved by the reversing gear but which do not carry any weight on the gear, that is not true. But the parts of the valve motion itself of the Baker gear, the reverse yoke, hangers, radius bar and gear connecting rod and parts belonging to the valve gear proper. The only variation on the radius rod among the different classes is a slight variation in length, which will make a slight

variation in weight. But considering all of the parts, starting right from the valve and all of the way back, the difference in total weight between all of the parts making up the valve motion and reverse gear on the engine that weighs 141,000 pounds and the one that weighs 298,350 pounds is 33 pounds. That variation comes in in the different length of the valve stem, a difference in the union link and eccentric rod and parts like that.

The total weight of the parts on the K–1–D is 1,685 pounds. That engine weighs 141,000 pounds. On the L–1–C the total weight of the parts is 1,718 pounds, a difference of 33 pounds. The frame that supports the valve motion is not included in those total weights. Included in that is the weight of the valve complete, valve stem, valve rod, valve rod cross-head, bell crank, radius bar, reverse yoke, gear-connecting rod, combination lever, union link, eccentric rod, gear-reach rod, reverse shaft, reverse shaft arms, and main reach rod. That does not mean that when reverse gear is moved that the force necessary to lift that amount of weight has to be exerted. Of course, what has to be moved varies with the type of valve gear. In this particular gear, the Baker gear, the parts that would move when the engine was reversed, starting from the reverse lever forward, would be the main reach rod. You can move that, and that
1672 in turn will move the reverse shaft and reverse shaft arms. That is connected with the reverse yoke which will move the gear connecting rod, the radius bar which will move the upper end of the combination lever, which is connected to the valve rod, which will move the valve stem and valve. These various parts are connected one with the other by pin connections and bushings.

The movement of the assembly (tumbling) shaft is the angular rotated movement. The tumbling shaft runs across the engine and is held in two boxes, and when it moves it is a rotated movement in a certain angle of distance. The tumbling shaft on the K–1–D weighs 320 pounds and on the L–1 engines it is 341 pounds. The tumbling shaft extends from one side of the engine to the other and has an arm extending out from it. It has really three arms. It has one arm extending out to the front end of the reach rod to which it is attached. That arm is approximately 16 inches long. By moving the reach rod forward or backward with the reversing lever on the hand operated gear with that leverage of the 16-inch arm of the tumbling shaft that causes the tumbling shaft to rotate either backwards or forwards as the movement is made. It rotates in bearings and bushings in which provision is made for lubrication. The amount of force exerted on the hand lever to cause that 300-pound tumbling shaft to rotate in order to reverse the engine from either forward to backwards or backwards to forward position would be a comparatively small proportion as compared with the weight of the shaft itself, because when you move it you are not lifting the shaft at all; it is merely moving it. The weight is supported by the boxes. As to how far the shaft rotates in the throw

of the lever from backward to forward position depends upon the type and design of the gear. I would say roughly about 90 degrees, in some cases a little more or less (5853 to 5861).

1673 In moving the gear from one part (point) to the other the rear end of the radius rod would be lifted. That rod is roughly 5 feet long and weighs 55 pounds. It is connected at the rear end to the bell crank and at the front end to the combination lever. When the gear is reversed the rear end of the radius rod is lifted. The proportion of the weight that comes on that pin connection would be lifted. With the Baker gear that is the only part of the valve mechanism that is actually lifted. The remaining parts consist of an angular motion. A difference in steam pressure, for example, one engine carrying 160 pounds and another 200 pounds should not make any difference with a piston valve. They should be balanced. With the slide valve the steam pressure should not make any difference if you have a perfectly balanced slide valve. We do not have such a thing on the New York, New Haven & Hartford. We have a balanced slide valve, but with what is ordinarily termed a balanced slide valve there is a slight percentage that is unbalanced. You could not call it a 100 percent balanced.

I have been testifying about the Baker gears. On the Stephenson gear you lift the weight of the links when you reverse the engine. The work that the engineer must ordinarily do in reversing different engines would depend wholly upon the design of the gear. It would be possible to design the gear so that the work would not vary. On our engines that have Stephenson gear it would be practically the same regardless of the size of the engine. Of course, we haven't many engines now equipped with Stephenson gear. As to the Walscheart gear, all that will move there, all the lift will be back of the radius rod and the block link (link block). On the Walscheart gear, our engines equipped with the Walscheart gear, the weights are practically the same as between the different weights on drivers.

1674 With respect to the variation in weights on drivers of engines equipped with the Walscheart gear, some of them, the K–1–D engine, are 141,000 pounds on drivers, and the heaviest engine we have with that gear, the R–3–A class, weighs 261,000 pounds on drivers. With the Walscheart gear the various parts are not as interchangeable all of the way through as with the Baker gear. The weights are generally the same.

For the last four or five years, perhaps longer, the general aim in design of valve-gear parts is to get as light a valve gear as possible. The force required to move the valve is comparatively small, and the stresses set up in the valve-gear parts come largely from the inertia of the moving parts themselves rather than from the force transmitted to them by the action of moving the valves. The higher the speed the greater the inertia. I think the best examples I know of as to the Walscheart gears are typified by the Pennsylvania, the Reading, and the Jersey Central. They have developed ex-

tremely light design of Walscheart gear which is used on their heavy power. It is lighter than the types of gears used 15 or 20 years ago. That is accomplished in some cases by using some different sort of material, but not in other cases. I understand the Pennsylvania has in some cases used a heat-treated material. The Pennsylvania has been gradually working on this lighter design for a long time. I think they started on it about 10 years ago. I don't know whether they changed the gears on any of the old locomotives on the Pennsylvania. I imagine that those engines with the lighter gears are equipped with power reverse because they are big power and you could not get the hand gear on them (5862–5868).

With reference to the lifting of the links on the Stephenson valve gear and as to what extent and in what way the force necessary to accomplish that is modified, in every valve gear the reverse
1675 shaft has a counterbalance spring on it. It is designed and constructed to balance the weight of the parts that are lifting, which it does if maintained properly. It will not balance at all points in the stroke to the same extent. You cannot get a 100% balance all the way through the stroke. On the Stephenson gear the effect is to balance the weight of the link and reduce the force that is required to be exerted on the reverse lever and transmitted through the reach rod in order to remove (move) the reverse shaft. When the links are in the bottom position, that is, when they are down as far as they will go the position of the hand reverse lever on the Stephenson gear is usually in the forward corner. It may be arranged either way, depending upon whether it is open or cross blades. When the links are in downward position—that is, at the lowest point to which they normally go in operation—the compression would be the greatest on the counterbalance spring. When the reverse shaft arm is moved that compression gradually diminishes as the arm is moved through its angular motion. When the links are at the highest point of their movement the counterbalance spring is relaxed to an extent. It may not be completely relaxed, but it has less compression than when at the bottom.

I compiled the exhibit previously marked for identification as ex. no. 73 during Mr. Moriarity's testimony relating to train delays and engine delays on the New York, New Haven & Hartford Railroad. The information was taken from these engine failure reports [indicating] for the years 1928 and 1929. I went through the total of all those reports and selected the reports that had any engine failures or train failures in connection with which reverse gears, either power or hand, were mentioned and that is what I have shown on this exhibit, which to the best of my knowledge and belief
1676 is correct. I had a man go through all of these reports and pick out first all reports in which the delay was caused by any part of the reverse gear or valve gear, or anything like that, then I went over all of those myself to determine whether it was

part of the valve gear or part of the reverse gear that caused the delay. These records are kept in the regular course of business on our railroad. The record is made by the superintendent of each division and it is sent to the general manager, general superintendents and other division superintendents, and to the mechanical manager and the mechanical superintendents and master mechanics of each division.

(Counsel Morehouse offers exhibit no. 73 in evidence.)

WITNESS (continuing, in answer to questions by counsel for complainants). Although I am not absolutely positive it is substantially correct to say that the information given in this exhibit was originally communicated orally by the engineer on the engine involved to the conductor and reported on the form by the conductor to the superintendent and then the reports which I have here were made up by the superintendent. I think in a lot of cases the conductor's report is transmitted by wire to the superintendent. I do not know of my own knowledge whether the causes reported on this sheet were the causes of the failure. I was not present and did not see them.

(Counsel for complainants objected to introduction of exhibit marked " No. 73 " on the ground that they are deprived of an opportunity of examining the man who furnished the information and knows about the causes of the delays. Objection overruled.)

1677 Exhibit no. 73 received in evidence.

WITNESS (continuing). The same method of counterbalance is used on the Stephenson gear as on the Walscheart and Baker gears. The arrangement is made to vary to fit the different types and sizes of gear as may be desirable. That is what it is there for—a counterbalance designed to suit conditions. There has been no difficulty in accomplishing counterbalance so far as I know from a design standpoint (5868–5875).

The purport of my testimony is that the weight on drivers is not a factor that influences the power required to handle the reverse gear. It is not the purport of my testimony that from the standpoint of design if the power reverse is required on larger locomotives, by the same token it should be required on smaller locomotives. The purport of my testimony is that the power required on the large engine—that is, using the term " large engine " to cover weight on drivers—is not much greater than on the small engines, that is, within the range of a few pounds, but that does not mean that the power reverse on a large engine is required on account of the power necessary to move the reverse lever. The power reverse gear is applied on the large engine because we haven't got room to put a hand gear on there on account of clearance limitations, and so forth. I do not say that from the standpoint of design if the Commission orders the power reverse gear on any locomotives, to be logical it must order it on all of them, because I don't know what the conditions are with regard to valve gears, and so forth, and so on, all of these different types of

locomotives; but as a general proposition it would be logical and possible that on the larger locomotive it would require no more power to move the gear than on the smaller. So far as our railroad is concerned I know that as a practical matter such conditions actually obtain in the operation of locomotives. I have myself handled the hand reverse levers on almost every different class of engine
1678 we had during my work in the testing locomotives. I cannot see any material difference in the force required. For instance, the 1-2's weigh about 154,000 pounds on drivers and the A's only about 80,000 pounds on drivers.

If the Commission should conclude that power reverse gears should be applied to some or all of the locomotives now equipped with hand gears the logical time to apply such power gears would be the time when making classified repairs. In order to get your bracket on the boiler to hold the reverse gear cylinder it will depend upon the type and design of the reverse gear you put on. But it is a pretty big job for a boiler wash. If you have the flues out of the boiler you can do a better job. The flues are not out on a class 5 repair that covers repairs to machinery, wheels dropped, turned, and general repairs to machinery, but not removal of any flues. We like to rivet these brackets on to the boilers and not depend upon the studs. It would require class 3 of heavier repairs. I would not want to take them in to do it on anything under a class 3. Class 4 does not require removal of all flues. There are very few class 4 repairs being given locomotives today. The time for making class 3 or heavier repairs would be the most economical for this work.

(Witness temporarily withdrawn) (5875–5879).

(No cross-examination —5888.)

JULIUS H. PARMELEE, director, bureau of railway economics, Washington, D.C., testified:

"The bureau of railway economics is maintained at Washington by the steam railways as a clearing house of general transportation information. My duties as director are to supervise and di-
1679 rect the activities of that bureau in the preparation of statistical and accounting statements relating to transportation. I have prepared a series of statistical statements for use in this proceeding.

(Statement consisting of seven sheets which purports to show the condition, financial and otherwise, of class I carriers as a whole for various years from 1920 to 1931, offered in evidence as exhibit no. 93.)

(Receipt of exhibit marked "No. 93" objected to by counsel for complainant on the ground that it is just a compilation by the witness and that he knows nothing about the verity of his fundamental information. After some discussion between the examiner and counsel as to the admissibility of the exhibit and the weight to be

given to the information therein contained examiner rules out sheet 7 which was taken from special compilations made by the railroad age but reserves ruling with respect to sheets 1 to 6 to permit the compilation of similar data with respect to the individual railroads, 5879–5887).

At this point counsel for complainant points out that upon making a check of the return made by defendants in connection with complainant's exhibit no. 13, of the types of equipment, and as to whether the locomotives covered in that exhibit were equipped with hand or power reverse gear, he finds that on several of the locomotives reported by defendants to be equipped with power reverse that the equipment was manual reverse at the time of the accident. Counsel for defendants expresses willingness to recheck and correct data previously submitted upon being furnished with list of engines as to which there is doubt concerning how they were equipped (5888–5889).

A. B. FORD, St. Paul, Minn., master mechanic of the St. Cloud and Wilmer division of the Great Northern Railroad, testified:

I entered service in the Great Northern February 1895 as locomotive fireman; promoted to position of locomotive engi-
1670 neer in 1896 (had previous experience on other railroads).

Promoted to traveling engineer in May 1901 on Dakota division; transferred to Montana Central at Great Falls 1903—now Butte division. I was promoted to master mechanic November 1905 headquarters at Minot, N.Dak. Served as master mechanic from this time at Minot, Great Falls, Montana, Larimore, N.Dak., until 1917. Was promoted general master mechanic of central district, consisting of the Kalispel division, Butte division, Montana division, January 1, 1926, transferred to Superior, Wisconsin, as general master mechanic of the Lake and eastern district. In May 1928 transferred to St. Paul as general master mechanic, of the same district with headquarters in St. Paul. October 1st, 1931, made master mechanic of the Wilmer and St. Clour division. On account of depression all general officials have been reduced on the Great Northern Railway.

In working as locomotive engineer from 1896 to 1901, all of my work was with hand operated reverse gear. I never was injured nor observed any injury due in any way to the hand lever operation. I cannot recall any instance of the lever having got away from me, or going into corner, and I cannot recollect any instance where the lever unlatched and moved to the corner. Nor can I recall of ever having observed such occurrence take place upon engine I have ridden as traveling engineer or otherwise. By the expression "going into the corner" I mean to move to one end of the quadrant in case of lever becoming unlatched. Unless the spring which exerts a downward pressure upon the latch, or dog, is broken or gone the

lever will be most apt to latch itself in one of the notches of the quadrant before reaching the corner.

My practice in handling the reverse lever was in general similar to that testified to in this hearing by a number of
1681 engineers from various railroads. As to the hard handling of engine I cannot recall operating any engines or engine that tested my strength or in any manner gave me unusual exertion. My principal work as an engineer was in mountain work, where in hooking up or dropping down of the reverse lever it was generally done under very heavy throttle. That is to say with full admission of steam to the cylinder, and I experienced no danger to myself in doing so, and this involved no unusual physical effort on my part.

Since leaving the service as locomotive engineer I have operated from time to time locomotives equipped with hand reverse lever. While as traveling engineer and master mechanic I rode and operated most of the engines that I was on and do so occasionally yet.

In common with all railroads we are gradually improving our power and our efficiency in maintenance of hand lever, along with all other parts of locomotive and other equipment, so that today there is hardly any comparison with the condition of power generally and including the hand reverse gear as to what it was 25 years ago.

It is our practice when an engine is turned out of the shop with classified repairs or out of the roundhouse with light repairs that one of our mechanical inspectors go over this engine carefully, and all adjustments are made at this time. Such adjustments may be necessary in any case in order to make the reverse lever work freely and are readily and easily made either by engineman who is breaking in the engine or by shop or roundhouse force.

All hand reverse lever power is equipped with an extension at the forward end of the quadrant, that is, a bolt extending through
1682 the quadrant about 7 inches toward the outside of cab. Also we have a cast iron foot rest, if so desired.

The last few years we have been rearranging pipe arrangements in cabs, particularly steam pipes to injectors, airbrake pipe, and such, so as to give more clearance in the forward portion of the cab. As to hand lever interfering with the duties of the engineman, the duties of looking out, in my experience I have not observed it doing so with other enginemen, nor interfering with their view of crossing nor obstruction. Nor have I experienced any difficulty myself.

The first power reverse gear the Great Northern had was the McCarrol gear. The motor to this gear was a four-cylinder motor, constructed similar to a pneumatic shop motor, connecting to a worm which moved the motion. Was exceedingly unsatisfactory on account of the slow movement. These gears were all taken off and Ragonnet applied. In 1919 we received nine 0–3 engines equipped with the Lewis reverse gear. These gears caused a great deal of

trouble and were all removed and applied to switch power, and Ragonnets put in their place. In 1925–27, 28, and 29–30 we purchased engines with the Ragonnet gear, class R–1, and 2. 2–8–8–2. Weight on drivers of 537–544,000 pounds, with Ragonnet gear. In 1929 we purchased four passenger engines, 4–8–4; weight on drivers 270,000 pounds with Ragonnet gear. In 1930 we purchased 14 4–8–4, 247,000 pounds on driver, with Barco reverse gear.

We have repeated complaints regarding the failure of power reverse to properly operate. The principal complain is creeping and working very close to center and in some instances going by the center and bucking train, as it is called.

We have experimented with the McCarrol, the Lewis, Ragonnet, the Barco reverse gears, and as yet have not overcome the creeping.

These facts that cannot be disputed show that the power re-
1683 verse gear is really in the experimental or development stage as yet, as they do not effectively fulfill the purpose for which they have been designed.

In the operation of a railroad we find that there are coming on the market all the time a large number of mechanically operated appliances. It is impossible for the railroad to provide funds to buy all the appliances as fast as the same are available. In the case of the power reverse gear, it is apparent that our railroad has gone a long way, in view of the defective performance we have experienced, and so far as the safety of locomotive operation is concerned. I do not consider we would be justified in spending any money for power reverse gear, taking into consideration all the factors involved, my experience as an engineer, based upon my knowledge of the needs and requirements of the railroad mechanically. It is my opinion that the money to equip all of our engines, amounting to over $300,000 (many of which are rapidly becoming obsolete) could be used for to much better advantage in the mechanical department than for this particular purpose.

In 1930 there were 30 engines written from the records, 50 will be written from the records this year. The cost of maintaining power reverse gear, the only records we have of a test for cost was on 9 class 0–3 locomotives equipped with the Lewis reverse gear. During this period these gears were repaired three times, which cost $2,256 per engine, which included labor, material, and machine work. The total cost for the 9 locomotives was $636.44. In addition to this other minor repairs were necessary, including oiling, which makes an additional cost, including lubrication, of $51.87 for a period of 12 months.

Total cost $1,107.27 or $123.03 per locomotive for 12 months.

1684 No cross-examination.

Witness excused (5889 to 5895).

At this point counsel for defendants (Mr. Thom, Jr.) presents statement of supplementary information as to net income, dividends

paid, and balance, previously requested of Witness Lehmkuhle, which statement was received as exhibit no. 93.

FREDERICK KERBY, Cumberland, Md., assistant to the chief of motive power, Baltimore & Ohio Railroad, testified:

I started my railroad career on February 14, 1880, as brakeman with the P. R. R. at Renovo, Pa., and went firing on July 3 of the same year. On December 23, 1886, I was promoted to the position of engineer, my first work as an engineer being in yard service, next in freight, and extra passenger service, until June 1899. During the time as an engineer I ran about all classes of locomotives used in that district; from the class B to and including the class H–6, ranging in weight on drivers from 60,000 pounds to 160,000 pounds, 0–4–0, 4–4–0, 4–6–0, 2–6–0, 2–8–0; all of these engines were equipped with manually operated reverse bars and Stephenson gear.

During my time as an engineer on the middle division of the Pennsylvania Railroad, running between Renovo and Kane, Pa., about June 1894 I had occasion to reverse an engine at a station called Sterling Run at a speed of 30 or 35 miles per hour, to prevent striking the rear end of a train, due to a flagman not being back a sufficient distance. I followed the caboose of the train ahead for almost ⅛ mile within about 15 car lengths of the caboose, until the train ahead gained speed on the train I was hauling and was just about stopped. I am making mention of this to show that an
1685 engine can be reversed with the manually operated bar at a pretty high rate of speed. We had about 70 or 75 loaded cars back of the engine; was running with a straight air brake on the engine and no air on the train; the front brakeman and fireman got off of the engine about 45 car lengths before I got stopped; the caboose looked very large ahead of me.

In the month of June 1899 I accepted a position with the Pittsburgh, Shawmut & Northern Railroad as road foreman of engines. During this time, about two years, I had charge of, and at times ran, the engines; they were the 4–4–0, 2–8–0 and the Shay gear-type engines. I do not remember the weights on drivers.

In the month of August or September 1900 I accepted a position with the N.Y.C. & H. R.R. as road foreman of engines on the Mohawk division (passenger service). While in this service I had charge of, and at times handled, the engines, type 4–4–0, 4–4–2 and 4–6–0. I do not remember the weights on the drivers, but all of these engines were equipped with manual reverse bars, and handled very easy when properly maintained, which was done at all times; these engines were all in high-speed service.

In February 3, 1903, I came to the Baltimore & Ohio Railroad as an engineer, and ran engines on the west end and east end of the Cumberland division, also on the Wheeling division, until March 31, 1905. One year of this time I worked as trial engineer at Cumberland, Md., breaking in the newly overhauled engines after being

turned out of the shops. I also ran yard, freight, and passenger engines in extra service, handling about all classes of engines in this district, weighing from 97,000 pounds to 173,000 pounds on drivers, 0-4-0, 2-4-0, 4-4-0, 4-6-0, 2-8-0. Some of these engines were what was called the deck engines, half-deck, and double-deck engines;
1686 some were of the 4-cylinder or Vauclain compound type engines; all of these engines were equipped with the manually operated reverse bars, and I found that the bars worked very easy after they were broken in properly. There were times when it was necessary to have some of the bearing parts refit before I turned the engine over for regular service, or before the engines were taken away from the shops; at other times, all that was necessary to be done was to lubricate the bearings properly, and adjust the counterbalance spring when necessary, and the bar would work very easy in a day or two.

During the month of May 1903 while handling one of the double deck or snapper engines in the year (yard) at Cumberland, Md., 2-8-0 type engine in yard service, weighing and classifying cars, the counter-balance spring broke and bar went down to corner, and I handled the engine in this manner for over an hour without any overexertion or injury before taking it to the shop for repairs. I reported the spring renewed at the roundhouse, but do not recall the number of this engine.

On April 1, 1905, I was appointed to the position of air-brake instructor on the lines east, instructing and examining engineers and fireman, also riding engines on the road, instructing engineers to handle the air brakes on the engines and trains in the proper manner. During the time as air-brake instructor, while on the road, I used to run the engine part of the time over some part of the division to demonstrate the work to the men, and I had to handle the throttle and reverse bar in doing this work; also during this period I first came in contact with the first Walscheart valve gear.

About August 1907 I was appointed to the position of assistant road foreman of engines on the Connellsville division, located at Rockwood, Pa. At this place I first came in contact, and had charge
1687 of, engine no. 3400 at that time, now changed to 7000, the first Mallet engine in the United States. It also had the first power reverse gear in the United States, known as the Melline or Melline gear. This engine is a class DD-1 type 0-6-6-0, all the weight was on drivers, weight 334,000 pounds and was built at Schenectady, N.Y., in May 1904 and was designed by J. E. Mulfeld. I ran this engine quite frequently while demonstrating same to visitors of other railroads and to instruct engineers after the engine was placed in pool service. During my time on the Connellsville division I had charge of and handled at times the 4-4-0, 4-6-0, 4-8-0 engines, weight on drivers ranging from 87,000 to 185,000 pounds, all equipped with manual reverse bar.

Later on in the years 1911 and 1912, the B. & O. had some more of the Mallet type engines built with the same power reverse gear on and which was described by one of the witnesses during the first part of the hearing.

On December 20th, 1909, I was appointed to the position of road foreman of engines on the Philadelphia division located at Baltimore, Md. I had charge of the passenger power between Washington, D.C., and Philadelphia, and freight power between Baltimore and Philadelphia. The largest passenger engine we had on this division at that time was the class P–4–6–2 type, weight on drivers being 150,000 pounds. In yard service we had the class M–3, weight on drivers 89,000 pounds. We also had all classes of small power in the yard on account of the condition of sidings. In freight service we had the class D–8–2–6–0 type, weight on drivers 111,825 pounds; B–18a–B–18b, 4–6–0, weight on drivers 119,000 pounds. E–27, 2–8–0 mm, weight on drivers 185,000 pounds. Class Q–1, 2–8–2, weight on drivers 218,740 pounds; all of these engines were operated with manual reverse bars, and I ran them part of the
1688 way over the road each time I rode on them, and that was almost every day from December 1909 until August 1911.

On August 1, 1911, I was appointed to the position of road foreman of engines on the Chicago division, located at Garret, Ind., and I had jurisdiction between Willard, Ohio, and Chicago, Ill., a distance of 278 miles. I worked on the Chicago division until December 31, 1912. While on the Chicago division the power that I had charged of was of about all classes and weights from 70,000 pounds to and inclusive of 218,740 pounds on drivers; the heaviest passenger engine that was on the Chicago division was the class P, 4–6–2, weight on drivers 150,000 pounds. In yard service we had E–14, 2–8–0 type, weight on drivers 131,000 pounds; E–16, 2–8–0 weight on drivers 153,000 pounds. All of these engines were equipped with the manual reverse bar, and I ran the engines at times as well as fired them part way over the division when riding with the crews. I do not recall that any person was ever injured with the manual reverse bar.

On January 1, 1913, I was appointed to the position of supervisor of locomotive operation on the Maryland district, with headquarters at Cumberland, Md., and held this position until about August 1917 when I was sent to Pittsburgh in a similar position and as fuel distributor during the war period. In October 1919 I was transferred back to the Maryland district in my former position as supervisor of locomotive operation. My duties while on the Maryland district were to look after the condition of power and the economical use of fuel, and to instruct the engine crews in the proper performance of their duties; while in this position I was on the road most of my time riding and handling the engines personally some part of each trip. I also did the experimental work on any new equipment and appurtenances that were applied to the engine. The Maryland

district is where the Baltimore & Ohio does the most of the
1689 experimental work and testing out of power. The east end of the Cumberland division is characteristic for testing purposes on account of the grades and the freight handled on the division, and this division is used for making comparative tests of the different classes of locomotives. I did the experimenting on valves, stokers, power reverse gears, and any other new appliances. We developed the first stokers on the east end of Cumberland division in 1912 and 1913. Only newly designed locomotives I assisted in locating the appurtenances in the cab with the view of locating same in the most convenient places for the engine crews, due to my experience as an engineer and supervising officer, taking the suggestions and recommendations from the enginemen and working out the most satisfactory plans, always keeping in mind to place the operating parts so that the engineer or fireman could operate same without having to leave their seat or hang part of the body out of the window, especially when the engine is working in the forward motion in which position most of the work is done on road locomotives. In yard work, it is generally so arranged when possible to do so, so that the engine is working most of the time in the forward motion so that the signals are given on the engineer's side so as to avoid having to pass signals from the fireman to the engineer before any movement can be made by the engineer.

During my time as supervisor at Cumberland I had charge of and had to handle or run about every class of engine on the district, and experimented with the different makes of the power reverse gear, such as the Melline, Ragonnet, Alco, Barco, and Standard, and I can say that I am satisfied that we are not by the experimental stage yet, as I find from experience and reports that all of these power reverse gears do creep and are not as economical in fuel and
1690 water as they should be, especially when they creep, and they cause damage to property, and personal injury, as has been shown by witnesses at this hearing. When the power reverse gear does creep it is not only wasteful in fuel and water, but also prevents the engineer from making fast or schedule time, and has caused damage to the locomotive as has been shown by witnesses during the first week of the hearing. It also causes a mental strain on the engineer which I know is much harder on him than pulling the manual reverse bar back. It has been shown by a witness that the cylinder head on an engine and the piston head on air cylinder was blown out on account of power reverse gear not working properly. The installation cost of power reverse is much greater than the manual reverse gear, also the maintenance cost, due to the many different parts to get out of order, such as piston head packing cups leaking, slide or rotary valve leaking; none of these parts is visible to inspection, piston rod packing leaking, cross head guides breaking, leaking air pipes also broken pipes which cause a failure or delay; it also requires additional work at the roundhouse to oil and lubricate the power reverse gear.

On January 1, 1927, I was appointed assistant to the chief of motive power and equipment, the position which I hold at the present time, doing special duty work such as testing out new engines, making tonnage and fuel and water tests, also long engine run tests. I just completed a three (3) months' tests on April 11, 1931, with four experimental engines, two mountain type class T–1 and T–2 4–8–2, weight on drivers 260,000 pounds and two simple Mallets KK–1 and KK–2 class 2–6–6–2, weight on drivers 372,000 pounds. Three of these engines are equipped with the Barco power reverse gear and one of the mountain type, engine 5550, is equipped with the Precision gear. This is the only engine we have with the Precision gear and I have not had very much experience with
1691 this type of gear. During the months of November and December 1930 I was located at the Baldwin Locomotive Works looking after the application of the power reverse and other appurtenances in the cab. The Precision gear worked hard at start when engine 5550 came out of the shop, but the other three engines gave considerable trouble. The two Mallet engines we had to use pinch bars to help get the engine to reverse, and they gave trouble at times during the test by not being able to get the gear to reverse the engine, but after they became worn, and the gear became better lubricated, it worked better, but you had to be very careful in moving the bar to a short cut-off or it would get back of center. The gear on these four engines is lubricated by the alamite system and this work is done by the shop force.

The principal reason for using the power reverse gear as I understand it is that on the modern power there is not sufficient room on the boiler head and in the cab to place the manual reverse gear; therefore we are equipping all of the new built engines with power reverse gear, but we have not considered it necessary to equip the remaining engines, many of which are becoming obsolete and will pass out of existence within the next three or five years, as the money that would be spent on these engines would be like throwing money away, as with the scrapping of the obsolete power we would also scrap a new power reverse gear that would only be in service a very short time and could not be used, as all other power would be equipped and it would not be serviceable for the modern power.

In all of my experience I have never found that I could not operate the manual reverse bar on the engines that I ran as an engineer or as a supervising officer with very little physical effort and also keep
the proper lookout for signals and highway crossings, and I
1692 never was reprimanded or criticized for not observing signals, or had any accidents at highway crossings and I never was injured in operating the manual reverse bar, and I do not recall any of the employees working under me being injured. An engineer does not have to place his head or body out of the window to see all signals, as he has a clear vision window that he can see through and observe signals at a reasonable distance, except on a curve where he

has to depend on the fireman or brakeman to call the signals at a distance and when he comes close to the signal he can see it from his side of the engine through the clear vision or side window. And as to the handling of the manual reverse bar to change the cut-off on the valves, there is no particular time when this must be done, and if the engineer uses good judgment as he should, he will cut the bar back at such time as he can see the road ahead of him or through the clear vision window. I personally have run an engine for miles in a stretch that I could see all of the signals and highway crossings through the clear vision window, and would not have to place my head or body out of the side window. I have also observed other engineers do the same, especially on cold and wet days and nights, and no accident occurred. The engineer does not always keep his eyes on the track as he has other duties to perform that require him to take his eyes from the track, such as watching the water in the boiler, and to put the injector to work, watch the air and steam gauges, and he generally arranges this at the time when he can see the road at a distance from his side of the engine or through the front or clear vision window, without passing any signals at danger or highway crossings, as it is his duty to blow the steam whistle before he reaches a highway crossing. I also have seen engineers run for miles with the side window closed in cold wet weather, depending on the clear vision window for observing signals and crossings, and that is what the clear vision window is for and is supposed to be maintained for that purpose.

1693 In road service, either passenger or freight, with the manual or screw reverse gears, you have a positive control of the steam distribution from the boiler to the cylinders at all times. But with the power reverse, which is liable to creep at any time, you do not have perfect control and when it creeps you do not have any control of the steam distribution, and from my experience and reports we have not up to this date found a power reverse gear that will not creep, and I consider the gear is still in its infancy, for it still has the desire to creep and does creep.

No cross-examination.

Witness excused (5896–5908).

Statement of mileage of locomotives equipped with power reverse gear and hand levers on the C. & N. W. Ry. Co., for year 1930, received as exhibit no. 94 (5910).

1694 Cleveland, Ohio, October 25, 1931

Statement by Mr. THOM, Jr.:

In connection with exhibit no. 92, Witness Ciliske, it was understood that we were to furnish a statement in detail by roads showing the estimated cost of installing power reverse gears. I offer this statement as exhibit 95. Introduction of exhibit objected to but objection overruled. Document received as exhibit 95, Witness Ciliske.

Defendants' evidence

JULIUS H. PARMELEE

DIRECT EXAMINATION

I offer for identification as exhibit no. 96 a statement of three sheets, one sheet being devoted to each of the three districts—east, west, and south—for the years 1929 and 1930 and for the first eight months of 1931, for each of the 153 class 1 railroads. It gives the total operating revenues, total operating expenses, and the operating ratio or ratio percent of expenses to revenues, the taxes, and net railway operating income. The statistics are from the annual or monthly reports. Sheet 1 deals with 59 railways of the eastern district. He testified that the statements were correct to his knowledge and belief. The question of what is a normal year is an extremely difficult question to answer. It has been emphasized to my mind quite fully that the 4 years, 1926, 1927, 1928, and 1929, with respect to freight traffic and freight revenue, which constitutes the principal and the bulk of the railroad business and the railroad revenues, were all very closely on a par. It happens that as to freight traffic the ton mileage handled by the railways in 1929 was a fraction of one percent greater than it was in 1926. In terms of carloadings, the totals for 1926 were a fraction of one percent greater than in 1929, therefore, the two years, 1926 and 1929, were about on a par. The intervening years, 1927 and 1928, were slightly below 1929 and 1926, but it happens that the year 1929, as to the freight business, was very close to the average of the years
1695 1926, 1927, 1928, and 1929. I think it may be said that these 4 years constitute a fairly close normal period for the railways, and that the year 1929 is fairly representative of that 4-year period.

I am not prepared to say, Mr. Examiner, that any one of those 4 years, or the 4-year period as a whole, is in fact a normal period, because that is a very difficult question to answer. However, the statement I have just made does throw some light on that question.

" Mr. STEVENSON. Are all the figures on this exhibit gathered from the reports made by the carriers to the Interstate Commerce Commission?

"A. The basic figures are. The percentage columns were calculated in my own office, and the operating ratio are all drawn from the sworn reports of each railway to the Interstate Commerce Commission. I stated, Mr. Examiner, that for the years 1929 and 1930 are from the annual report and clearly the figures for the 8 months were necessarily drawn from the monthly reports. Exhibit no. 96 received in evidence over objection of Mr. Stevenson."

Offered for identification as exhibit no. 97 a tabulation headed "Revenue ton-miles and revenue passenger-miles, years 1929 and

1930" from the annual reports of each railway to the Interstate Commerce Commission, and for seven months of 1930 and 1931 from the monthly reports to the Commission, class 1 railways, eastern district (including Pocahontas region).

"By Mr. THOM, Jr.:

"Q. Now, is this statement to your best knowledge and belief, correct?

"A. Yes, sir; it was prepared in my office under my direct supervision and like ex. 96 the statistics for the individual railroads are drawn as to 1929 and 1930 from the annual reports of each railway to the Commission and as to the 7 months of 1930 and 1931 from the so-called 'operating statistics reports', the monthly reports to the Commission dealing with the operating statistics. As in the case of ex. 96 there is a summary on the third page. Statement received in evidence as exhibit no. 97."

1696 Offered for identification as exhibit no. 98, a statement for all railways of class 1 combined showing the revenue ton-miles and the revenue passenger-miles for the years 1920 to 1930, inclusive, and for the first seven months of 1929, 1930, and 1931. Total ton-miles for 1929, a fraction of one percent greater than the total ton-miles for 1926, and the years 1927 and 1928 were midway between those two years. Received in evidence as exhibit no. 98.

The operating statistics report is filed with the Commission sixty days after the close of the month to which it applies. Total car loadings for the 41 weeks ending Saturday, October 10, 1931, were 30,107,689, for the corresponding period of 1930, the total was 37,079,738. The percentage of decrease 1931 under 1930, was 18.10 percent. The percentage of decrease, 1931 under 1929, the same 41 weeks, was 28.8 percent.

The cost of applying power reverse gears would be charged to capital expenditures. A railway must pay for capital improvements out of its surplus or it must finance them by issuing obligations. The question of financing obligations depends upon the general credit of the company, and that, in turn, largely depends upon the recent net earnings of the company. The credit of any company would be judged by its financial results for not more than three years past (T. 5917–5927).

In reply to the query as to whether or not the Santa Fe is in a financial position to expend $182,800 for the purpose of equipping their locomotives with power reverse gears, an analysis of the second sheet of exhibit 96 must be made. In 1930 the Santa Fe showed a decline in total revenues against 1929 of 16.5 percent. In 1931, the first eight months, it showed a further decline under 1930 of 15.6 percent. The cumulative decline would be approximately 30 percent, 1929 to 1931. In 1930 the decline in net operating income, compared with 1929, was 35 percent, and in 1931, the first eight months there was a further decline of 15.4 percent. The cumulative decline

from 1929 to 1931 was approximately 45 percent, or nearly one-half. Any company, strong or weak, which has suffered a loss of nearly one-half in its net income over a period of two years is ap-
1697 proaching the point where its surplus will be small or non-existent, and where its credit will be seriously impaired.

A railroad's traffic is the standard by which its final revenues will be determined. The Santa Fe appears as the second entry on the second sheet of exhibit 97. Its revenue ton-miles in 1930 showed a decline of 13.8 percent under 1929, and during the first seven months of 1931, there was a further decline of 9.1 percent. Passenger miles showed a decline of 15.2 percent in 1930, compared with 1929, and a further decline of 22.2 percent during the first seven months of 1931, cumulatively, the freight traffic of the Santa Fe this year is running some twenty percent under 1929, and the passenger traffic between 35 and 40 percent under. All in two years. The ability of a company to spend money depends upon its cash position rather than corporate surplus as certain property investments are carried on the books as corporate surplus. To properly determine the cash situation, it is not only necessay to pay attention to the cash on hand but also how much the railroad needs for working capital purposes, its financial needs over a period of months, the respective months of the year, and other factors of that kind.

The exhibits under consideration are very significant in that they show the existence of a cumulative decline in traffic, in revenues, and particularly in net income. Unless that decline is checked there will be scarcely a railroad in the country which will not be in financial difficulties, i.e., find it difficult to meet its interest charges and even possibly its operating expenses. The Commission predicts that its decision in the Fifteen Percent Case of 1931 will secure $125,000,000 per year additional income for the railroads. Their total decline in net operating income in 1930, compared with 1929, was $283,000,000 and they have suffered a further decline the first eight months of 1931 against the same period of 1930 of $205,000,000, or combining those two periods, 1930 against 1931, and only a part of 1931 against 1930, of nearly $600,000,000 in net income.

1698 The financial condition of some lines was much worse than others. The railroads in ex parte 103, filed no individual statistics. However, statistics were filed by representatives of the banking interests to show the financial position of each railway for the year 1931. If these gears are required to be put on as class 2 or 3 repairs, the expenditure would be spread over possibly three or four years and could be charged to maintenance. I am not competent to make an estimate as to what is likely to happen financially to the railroads over the next three or four years. I do think that these exhibits point in a very significant way to this cumulative decline and if it were a question of getting down to the final decision in the case of each railroad it would be necessary to go farther and make an intensive study and analysis of each railroad.

The bases used in the exhibits filed with the rate case by the banker interests were based on the returns of the period of this year to date. Those were projected, that is, the results were projected to the end of the year on the same percentage ratio. In addition a study was made with respect to each railroad as to whether that railroad was likely to receive from outside sources the same or a lesser income than it had received in 1930, and the final result was stated to the Commission. It appeared from the result of applying that method that about ⅓ of the largest railways in the country would fail to earn their fixed charges in 1931, ⅓ in number to nearly one-half when considered in terms of the aggregate fixed charges involved (T. 5927–5937).

I will refer only to the net income of the Pennsylvania Railroad drawn from the first sheet of exhibit 96. The railway operating income of the Pennsylvania in 1930 was 31.6 percent less than it was in 1929. During the first eight months of 1931 there was a further decline of 15.5 percent. Comparing 1931 with 1929, there was a decline of 67 percent or almost exactly ⅔ in the net railway op-
1699 erating income of that system. The Pennsylvania Railroad in June 1931 reduced its dividend rate from $4 a share to $3 a share annually. I don't think I can make an estimate of the shares outstanding.

The estimate with reference to the cost of installation of power reverse gears on the Chicago, Milwaukee, St. Paul & Pacific would be $515,525. The second sheet of exhibit 96 shows that that railroad suffered a loss of 39.5 percent in its net railway operating income in 1930 compared with 1929 and a further loss of 47.6 percent in the first eight months of 1931 compared with 1930. The cumulative loss as between 1929 and 1931 was approximately 65 percent.

There are railways that receive outside income and in some cases it is larger relatively than in others. They receive outside income from lease of road, from miscellaneous rent, from miscellaneous nonoperating physical property, from separately operated property, if any, and from dividends, that is, dividends from other corporations, income from funded securities, income from nonfunded securities and accounts, income from sinking and other reserve funds, release of premiums on funded debt contributions from other companies, if any, and miscellaneous. Those are several items prepared by the Commission. Concerning the financial ability of any particular railroad to respond to any order that the Commission might make I would go to the cash position of that railroad. I would include in cash four items which are shown on the balance sheet of the railroads under the accounting regulations of the Commission. Those items are cash, actual cash itself; demand loans and deposits; time drafts and deposits; and special deposits, most of the last three items being in banks. I do not mean to indicate that a particular road's ability rests solely upon cash position. The question of the earning power of the railroad over a period of years, its credit

position which rests on many factors as well as the cash position, would be taken into account. I think the question of how much corporate surplus a railroad had on its books would be of very little account because that point involves how much of that surplus is available for expenditure. I would like to explain it a step
1700 farther. I say there are 4 principal factors which would be taken into account, not the only ones, but the important ones, and I would place as first among those four factors the earnings, that is, the matters which I have been emphasizing in these exhibits. Second, the credit standing of the railroads, and that too rests on a large number of factors. Third, the cash position, and, last of all, the corporate surplus. In this connection a railroad might have, and I think that many railroads at the present time do have, large surpluses on their books whose earnings are so low that their credit standing is poor or even nonexistent.

The corporate surplus as defined by the Commission consists of additions to property which have been made by the railway through income and surplus, that is, additions that have been allocated out of net earnings for capital improvements. The next item in corporate surplus is funded debt retired through income and surplus. The next item is sinking-fund reserves; next is miscellaneous-fund reserves; next is appropriate surplus not specifically invested, and finally the profit and loss balance. Those six items are added together and the total is called by the Commission "corporate surplus." May I point out that cash does not appear in any of the six items that I read, for that reason cash and surplus have no direct relationship. In answer allow me to summarize first, current net income; second credit situation, that is, credit standing; third cash position, and fourth corporate surplus (T. 5937–5948).

Exhibit 98 shows the year 1920 was one in which the revenue ton-miles was over four hundred billion. Nineteen hundred twenty-two was a depressed year. Nineteen hundred twenty-three was a good year. Then the years of 1925, 1926, 1927, 1928, and 1929 were all over four hundred billion. Now 1930 dropped down to three hundred billion. The statistics for the first seven months of 1931 show there has been a further decline.

Referring to exhibit 96, to get a complete picture one would
1701 add the net income from outside sources and then deduct all those items which in the Commission's accounting regulations are called "deductions from income", and those deductions do not include dividend payments. They include chiefly the fixed charges and other similar items. I would consider net income after fixed charges as indicating what a railroad was actually doing in the way of securing financial results. It is necessary that a railroad in order to maintain its credit shall meet its fixed charges. The matter of dividends is a matter of policy which might be taken into account. I would not call it a necessity.

A. I. CILISKE testified:

In reference to exhibit 95 which showed the total number of locomotives as 27,807, that he had no way of knowing how many out of that number will probably not be used again (T. 5948–5958).

W. P. HARRIS testified:

That he was fifty-four years of age and was first employed by the Norfolk & Western in 1898 as a brakeman. He became a fireman in July 1898 and was promoted in 1902. He has had about twelve or fourteen years' experience with hand reverse gears and about the same length of experience with power reverse gears. He had never been injured with a hand reverse gear, nor has he ever seen anyone else injured by that type. He stated that on June 25, 1931, he was employed on engine no. 2004, a Mallet, in freight service. This locomotive is equipped with a Franklin precision reverse gear and that he was injured by the same.

I will state what happened in my own way. On this trip we had to assemble our train in the yard at Portsmouth, Ohio, and in doing so we had to double over. "When the engine got on the apex of the hump at the back through another track, in order to get the rear end of our train and pull it in, and with the leading engine, the low-pressure engine went over the apex of the hump and I had to start to reverse and the reverse gear kicked and caught my arm against
1702 the window and cut the arm open and bruised it up." I had hold of the reversing wheel. I was out of service for about four weeks, but I went back to work before I ought to and for six or eight weeks the doctor was taking care of me. The arm that was injured seems to get tired sometimes, but I work all right. The company paid the doctor's expenses and I was paid $2.50 from the company relief association that we pay into every month. I have never had any difficulty with manually operated reverse gears. The Alco is the only class of power reverse gears we ever used, except the Franklin. I have never received any injury on account of the lever power reverse, only the screw type of Franklin precision. I attribute the cause of the accident to the position of the engine. It was in a strained position, standing still, on the apex of the hump, part of the engine was on one side of the slope and the other part was on the opposite side of the slope and when the gear came over past the center it had to kick, it automatically went in reverse position. It had a latch, but that had to be unlatched during the time the engine was being reversed. I have had trouble with a Ragonnet creeping and have had it go back over center. Form T report covering the accident of Witness Harris was received in evidence as defendant's exhibit no. 99.

H. L. EMSWORTH testified:

That he was 47 years of age and first entered the employ of the Erie, October 6, 1902, as a fireman. He was promoted January 16,

1907, and was injured June 27, 1931, by a Franklin precision power reverse gear on engine no. 3392.

I will state the facts in my own way. "We had yarded our train at Kent, Ohio, cut the engine off, pulled up over the cross-over to back up to the shop track, the brakeman throwed the switch to the cross-over, gave me a signal to back up. I started to reverse the engine", made about two revolutions with the reverse wheel when it kicked back and the handle hitting my hand, broke my wrist. I was off duty as a result 69 days and was paid about $595. The doctor and hospital bills were paid by the company.

1703 I have never been injured with a hand lever. This engine is still equipped with the precision gear. What caused the wheel to spin, as near as we can determine, was the circumstance that the threads were stripped on the lower end of the tumbling shaft counter balance spring that equalizes the weight. The fact that the counter balance spring was out of adjustment and compressed caused a very unusual strain to be placed upon the tumbling shaft. If I had had a manual screw gear or a Johnson bar lever I would have gotten a kick too. Form T covering report of the accident to Witness Emsworth was received in evidence as defendant's exhibit no. 100 (T. 5957–5967).

R. I. LAMBRIGHT testified:

That he was a resident of Elkhart, Ind., and first entered employ of the New York Central Lines as a fireman December 31, 1924, and was last furloughed March 4, 1930. He stated that he was firing engine no. 281–W in switching service at Oakdale crossing in Toledo under E. W. Ross as engineer on the 4th day of September 1929; that locomotive was equipped with a Ragonnet, an air power reverse.

I will state the facts in my own way: "We were going through the interlocking plant from the opposite side of the right-of-way and we heard something catch on the switch point and we stopped and there was a brake beam down, so we pulled off the interlocking plant and cleared the road crossing and got tools and got down to take the brake beam out. As I got down I noticed that the engineer had put the reverse on center. The operating lever of the Ragonnet power-reverse was in the center of the quadrant and upright. We got down and started working under the tank to take the beam out and later I got back on the engine to see that the water and fire was all right. Then I got down again and was helping him and in about 5 or 10 minutes from the time I first got down the engine started to move forward. I got out and up in the cab and stopped the locomotive with the automatic and independent both. I noticed that the operating lever of the power reverse at that time was in the forward position and no one had been in the cab in the meantime. Then I got down and went back to see how badly Mr. Ross was hurt, if at all. I found him 6 or 8 feet back of the locomotive. He had a

crushed arm and appeared to have been struck on the head. There was a hole in his head. We staunched the flow of blood from his arm and I went to the tower and told the operator to call an
1704 ambulance. The engineer was lying down on the track under the tender facing the front and before the engine started to move. After the accident one of the switchmen volunteered to take the brake beam down, which he did, and I put the cars on another track off the switch lead, then put the engine on another track beside the water plugs. It was about an hour and a half before a relief engineer came. While we were waiting for the relief engineer I was sitting on the right-hand side of the cab and two switchmen were up there and we were talking about the accident. I had turned the reverse lever on center and the switchman called my attention that the reverse gear was creeping forward. I pulled it back up and it did the same thing over again. It moved slowly at first, a notch at a time, and when it got about two-thirds of the way down it went faster. It went down the entire distance to the forward point. I had not noticed it do that previously on that locomotive. The latch was raised slightly, just enough to let it get over one notch until it got part way down then it would keep ratcheting right on down. I do not think that the latch spring was unnecessarily weak. I have never been injured nor have I ever seen any one injured with a hand reverse lever. I am familiar in a general way with hand reverse levers and with power reversing gears. I have never observed a Johnson bar type of reversing lever move in a quadrant as much as one notch in either direction with an engine standing still and without any one operating the lever or raising the latch. In my opinion this accident would not have occurred if engine no. 281 had been equipped with a so-called "Johnson bar" type of reversing gear.

CROSS-EXAMINATION

I don't know whether this Ragonnet gear had leaky pistons in the cylinder and did not examine it for leaks. The latches on the quadrant were worn. When I got back on the engine to stop it I found the throttle closed. I just applied the brake. I did not test the throttle to see whether it was closed. I account for the steam that caused the engine to move by leakage and found that condition. The suposition is that if the engine moved with the throttle being closed, it was leaking. I don't know whether it was the throttle or lubricated choke that was leaking. I didn't notice any steam escaping from the cylinder cocks while I was performing the work under the tank. The cylinder cocks were open. I took no extraordinary precautions by blocking the wheels or anything of that nature. After the accident the corners of the quadrant notches seemed to be rounded and if pressure was brought on the lever it would slip.

1705 "Q. In your opinion if the quadrant latch had been in proper condition would it have moved?

"A. Well, I really could not say, but I don't see how it could have.

"Q. Did you ever have one move on any other engine?

"A. No, sir."

REDIRECT EXAMINATION

When I answered that if the quadrant and teeth had been in proper condition, I meant square and not worn at all. These were rounded so that if pressure was brought to bear it would gradually force the latch up. There was no square corner there at all. They were quite worn. The report of the Bureau of Locomotive Inspection was received in evidence as defendant's exhibit no. 101. Witness Lambright (T. 5969–5979).

FRED J. MILLER testified:

That he was district claim agent for the Toledo district of the New York Central Railroad and stated that Engineer Ross' right arm was amputated 3 or 4 inches above the elbow and that the injury to his head resulted in an impairment of his left side. They wanted their own doctor and consequently they paid their own doctor's bill. On July 1, 1930, I made a settlement with Mr. Ross on behalf of the railroad company for $10,000; there was also paid $1,402.85 for hospital bills and nursing services. Mr. Ross has not returned to the company service. He is now deceased.

Mr. Thom, Jr., on behalf of defendants, stated, with reference to exhibit 49, that the accidents to H. L. Neal on the Chesapeake & Ohio, December 25, 1930, and to A. J. Pothast of the Fort Smith & Western, May 27, 1929, were sustained on manually reversed locomotives.

S. W. MOLTE testified:

That he was a resident of Tucson, Ariz., and first entered the employ of the Southern Pacific Railroad in 1897 as a fireman and was promoted to engineer in 1902. He stated that during the past 5 years about 80 or 85 percent of the locomotives that he operated were equipped with the Johnson bar type of reversing gears. The engines that he operated were hand levers, were in local freight

1706 and switching service. They were the smaller class locomotive, about 194,000 or 200,000 on drivers and that he had never been injured in the use of hand reverse levers (T. 5978–5988).

I will relate in my own way an accident that happened about 3:45 a.m. on the 5th day of August 1931 at Esmond, about 17 miles east of Tucson. The track through there is double track around Tucson 40 miles east and there are no cross-overs from one track to the other anywhere in that distance so that we had orders to go to Vail, that is 4.7 miles east of Esmond, pick up a water car there,

bring it back to Esmond and fill it and return it to Vail. We went to Vail to get the water car and brought another empty along with it that was in front of it to save making a switch. Before we got to Esmond my main reservoir pipe broke between the pump and main reservoir and that let all the air escape out of my main reservoir and when I got about to the distance signal a little over 2,000 feet from the switch coming back to Esmond I went to set my air and the air had all drained out. I immediately reversed my engine and gave her steam. It was a Ragonnet, an air reverse. The air was gone and it did not reverse so that gave the locomotive that much more momentum right back toward the train. We were backing up with two cars in front of the locomotive. I reversed my reverse lever over in forward motion but it did not reverse, and that just gave her that much more momentum toward the train. I was on a descending grade of about 1% and was backing up with two cars in front of my engine. I did not discover that the air was leaking off until I got about two hundred feet from the switch, but the pipe probably broke about a mile east of the switch. There was no indication in the working of my engine to indicate that my air was escaping, but about the mile board before I got to Esmond I heard something that I thought was the engine popping; that is, the steam escaping from the safety valve. I discovered at the distance signal that my air was escaping when I went to set my brake and had no air. I told the fireman I had no air and we were going to hit the train and he got on top of the tank and I got on the steps of the engine and I stepped off about a car length before we
1707 hit the train. I judge we were going about thirty miles an hour at that time. Our speed was about twenty-five miles an hour until we got to the distance signal and I figure she picked up at least five miles an hour after I gave her that shot of steam. If the engine had reversed I could give her steam and could have stopped before we hit our train. I immediately shut off steam after I saw she wasn't reversed. The locomotive hit the train, the tank was sheared off the train and turned upside down. The brakeman was sent to the hospital with a sprained ankle. The fireman had a bad fractured left leg between the knee and the hip. The brakeman and myself were in the hospital for a week, the fireman has been in the hospital many months and the doctors say it will be a year before he is released from the hospital. There was an auxiliary steam connection on this power reverse for the purpose of cutting in the steam in the event of an air failure and I knew that connection was there. I didn't attempt to operate it because I did not have time. There are two valves involved in cutting in that emergency steam. As to how far away from the train I was when I tried the air and found out I had none, I would say about twenty-five hundred feet. At different times when my brake would fail, brake beam or brake lever or something of that kind, I have used the hand lever for braking purposes on more than one occasion. At different

times I have, when my brake would fail, brake beam or brake-lever, something of that kind. I recall an instance some three or four months ago when I broke a driving brake-beam, and had to use my reverse lever in switching the rest of that trip until I got to the terminal. In so doing I was able to control the movement of my locomotive in that way. I have done that a number of times, but that is the only specific time that I remember of right now. I have also handled trains in off the road where I had breakages, leaving me with only the power on the drivers on one side of my locomotive—the engine on one side—and I have been able to get in with my trains under those circumstances, but you cannot handle a full tonnage train that way. This accident would have been avoided if I had a lever Johnson bar engine; that is, a hand lever (T. 5988-5998).

1708 With a hand lever gear I could have stopped still in a quarter of a mile. There are two steam valves, one of them up at the fountain and the other was outside under the running board. On the usual locomotive there don't seem to be any standard place for them. On a number of engines they are that way. Some of them have them in the cab with the second one on the side of the bar and the other one at the fountain. On my engine the valve was right under the running board on the right hand side. I could have gotten out of the cab and laid down on the running board, got down on my hands and knees and turned it in and the other valve is up at the fountain in the cab, and of course, with one minute that would not be time enough to open these valves. I can get out of any of the smaller engines through the front cab window on to the running board but can not the larger ones because the cab is practically full. Had the valve on this particular locomotive been located inside the cab along the boiler I wouldn't have had time to cut it in and get the steam in and slowed up my engine. The valve at the fountain is inside the cab on top of the boiler. In order to reach it you probably might have to step on something. You have to get up to the fountain to turn on your lubricate or steam valves and three or four other valves. The fountain valve would be the first one you would get to on the right hand side. The different valves are marked to identify them; that is, "blower", "steam valve", "lubricator." The second valve in the steam line is to prevent steam, an extra precaution, leaking through to your reversing gear packing. If the steam gets in there it will ruin the packing to your reversing gear. You have to put in new packing then. Just as good a job of switching can be done with a smaller engine with the hand reverse gear as can be done with steam, but of course it is more work. I have found in my experience that there is no difference in one's ability to keep a look out in operating engines equipped with the two types of reverse gear, the hand and the power. In general I don't consider there is any difference from the standpoint of safety as between the two types of gears; that is,

1709 taking in general the safety of operations of locomotives. In this particular case I mean if I had had a hand reverse I could have prevented the accident in that specific case of August 5. Taking it all and all, I don't think there is any difference as to safety between the two types of gears.

CROSS-EXAMINATION

When I am in local service or switching I keep my eye on the man on the ground at the rear of the train for signals, whether the locomotive is equipped with a Johnson bar or a power reverse gear. If steam happens to be trapped in the cylinders and there is difficulty in getting the Johnson bar over, I would be compelled to draw my head inside of the cab and of course would lose sight of the man for that time. Then I would not start the locomotive without obtaining another signal from the man on the ground. The power reverse gear is a labor saving device. You feel that you have done a whole lot of work after you have switched 2 or 3 hours with engines equipped with manual reversed gears (T. 5998-6008). After working 16 hours with a manual reverse locomotive you probably would feel more tired than if you have a power reverse in the same kind of service. The form T report to be supplied by the Federal inspector will be given exhibit no. 102.

In referring to the accident I wish to state that when you set your brakes with E. T. equipment your braking power comes out of your main reservoir and when your main reservoir air goes you have no brakes. We were backing up with two cars ahead of the engine. We were pulling them and the brakeman was riding them. When I discovered I had no air I began to blow my whistle in case there was anybody down at the switch to put me down the main line. I did not have the air coupled in on my cars. If the air had been connected to the cars it would have set the brakes on them. I did not consider it necessary to have the brakes cut in on this switching movement. We have a rule that says that when the train is cut into two or more pieces, you will couple up your air and pump up to at least 60 pounds and draw off 10 pounds and get a plug test from the rear of the train, but we did not have our train. Accord-
1710 ing to the rules you have got to have markers before you have a train. I had two empty cars—was all. When I spoke of a brake beam being broken and I had to use my reverse lever to handle my engine, I referred to the main driver, brake beam right side. I could still use my tender brakes, but is was necessary to use my reverse bar because a tender isn't going to hold two or three cars. You cannot count on it holding your engine. It has an effect, it wasn't made to hold the engine, just merely to hold the tender. I have operated a locomotive that did not have engine brakes at all, and could handle the engine with the tender-brakes, but you have to be going slow; going ten miles an hour, you could.

"By Mr. McLAUGHLIN:

"Q. Now, did you do your braking on this occasion with your reverse bar, or assist in stopping your engine with the reverse bar?

"A. You might say you assisted, but it is most with the reverse bar, because as I say, your tank brakes have very little effect on your engine (T. 6008–6018)."

In response to question will say that in reaching your main reservoir valves you have to put your foot on your reach rod to get up to the valve. If you want to reach the valve on a manual reverse bar you would have to put your foot on the reverse lever or upon the quadrant sometimes. The size of the locomotive under consideration was a two-eight-two, or about 206,000 pounds on drivers. We haven't any locomotives of that size operated with a manual reverse lever. The heaviest locomotive that I have ever operated equipped with manual reverse bar was about 200,000 pounds on drivers. The rails were slippery but I could have put sand in front of the two front pair of drivers. About half-way down I looked at the air gauge. I looked at it because I was looking at that single track. It is a double track but that has a block signal system for signaling trains and I reached over to see how the intermediate signal was. You are never supposed to shut off your steam while your engine is moving. I was getting down close enough to the side tracks to slow down and I put on the air, just feeling of it to slow down, but I had no air. If you lose your air I think it
1711 would take about three minutes to cut in the steam if the valves were where I could get to them handy and getting my steam to the reversing gear. You have to cut it in and wait for it to run in there. It takes time to do that. I would consider that it would take a minute to open those two steam valves if they were in proper working order and easily within reach. You would have to give the wheel several revolutions to open the valve full. I believe that after you got the valves open that it would take two minutes for the steam to then get into the power reverse cylinders so that it would operate it. The head brakeman coupled these cars to the locomotive at Vail. He asked the second man if he wanted the air cut in and was told that it wasn't necessary. I knew it was not coupled up. I always considered it a switching movement. Over objection of Mr. Morehouse the witness stated that he was taken out of service for a while as disciplinary action for not having the air cut in these cars attached to the locomotive (T. 6018–6028).

As we left the siding to go back down to Esmond I set my independent air and slowed down, thinking that probably the brakeman would want to go to Esmond with us, but he stayed at Vail. As a result of that action I knew I had air on my locomotive at that time. I wish to clear up one thing, an engine equipped with a hand reverse lever does not have this valve on an auxiliary steam line. There would be no valves whatever to stop to operate if you had a

hand reverse lever and wanted to reverse the engine. It has been possibly two or three years since I have had to work 16 hours. Since business has been so slack I work anywhere from 6 to 9 hours. With respect to your sometimes pulling your head inside the window or looking inside the cab in switching movements with hand reverse lever and then again looking to get the signal from the man on the ground, the practice is practically the same whether you have a power reverse gear. Ordinarily you can throw over the power reverse quicker than the hand lever.

A. M. COLLINSON testified:

My residence is Carlin, Nev., and I am employed by the
1712 Southern Pacific in the capacity of brakeman. I wish to recall an accident which occurred on August 27, 1931, on locomotive no. 3634. The person injured was J. E. Stevens, fireman. We had cars to pick up off of no. 1 and I went back to get the pin after I had sprung the air on the train. I could not get it, it was stretched out, I motioned for a back-up sign and stood there and motioned again and could get no response. Stevens got down and looked around and went up in the cab to find out where the valve was shut off and he got down to the ground and noticed where it was shut off and stood on the counter balance of the driver and turned a valve on the reverse outside and she backed up, crushing his foot between the counter balance and the side rod. I motioned to the engineer after the air had been turned in and I picked the boy off the ground and took him to the doctor. The valve is located along side the air reversing gear, and as soon as he turned that pipe the air shot into the cylinder and it kicked back. My purpose in calling them to move back was so that I could get the necessary slack to enable me to uncouple. After the fireman turned the valve the engineer could move it forward. He pushed her in a forward motion and released it. When this valve was opened the wheels revolved and the engine moved backward about 4 inches, taking his foot up with the counter balance under the side rod (T. 6028–6038). It could not move forward because the slack was already out forward, he could not pull it forward until he got the slack out backwards. Form T reports were received in evidence and marked defendant's exhibit 103, Witness Collinson, and defendant's exhibit 104, Witness Collinson.

The defendants rested, and complainants proceeded with their rebuttal.

WM. H. COTTON testified as follows:

That he submits a statement showing engines out of service as of August 28, 1931, and subdivides them as between power, screw, and hand gear. Number stored, power 108; screw 30; hand 87; total 225. Number in order awaiting shop for classified repairs, power 62; screw 12; hand 17; total 91. Number in order awaiting

1713 shop for running repairs, power 51; screw 3; hand 35; total 89. Condemned, power none; screw none; hand 11; total 11. Total out of service, power 221; screw 45; hand 150; total 416. That is for the Erie Railroad and operated lines, which includes the C. & E., New York, Susquehanna & Western, and New Jersey & New York. With reference to exhibit no. 95, it may now be said that there are 11 locomotives on the Erie now set aside awaiting disposition.

JOHN H. MCHUGH, testified as follows:

That he was a resident of St. Paul, Minn., and entered the employ of the Great Northern Railway Company July 28, 1932, as a fireman and was promoted to engineer October 1, 1899. He stated that he was now in passenger service handling trains 3 and 4 between St. Paul and Breckenridge, Minn. It is about a 215-mile run. No. 3 has 13 regular stops and some flag stops, and no. 4 has 21 regular stops. These trains use mountain type locomotives 4–8–2 and weight 242,000 pounds on drivers, known as T–2500, P–2 class. I have been operating these engines for about six years. We have three men who man these trains between St. Paul and Breckenridge—myself, Ralph Davis, and Harvey Rowe, Mr. Rowe being the man who testified in this proceeding this spring. I have been running opposite Mr. Rowe for about five years and ten months, and I have been operating the same engine out of St. Paul as Mr. Rowe brought in during the last two and one-half months.

Over objection of Mr. Morehouse, Witness McHugh was allowed to state that he kept a record from about September 25 to October 10 with reference to the power reverse as to whether or not it was creeping or whether he had any trouble in any way with it and the witness stated that he did not. The witness stated he has had the experience of undertaking to use the hand-lever, Johnson bar, for the purpose of a brake to control the speed or direction of his locomotive. He stated: "I remember it one time especially. I have used it a good many times, but I never had any trouble, except this one time with it, and this was at Huron, South Dakota, in the
1714 year, I should judge, 1914." It was a standard engine with slide valves. It was in the wintertime, about 30 degrees below zero, and we had had a six-hour lay-off and the engine stands outdoors and it was snowing and blowing snow on the brakes and we took the engine out to the passing track and back to the coaches. The head car was a baggage car and the second was the day coach or smoker you call it, I guess, and the brakeman was down at the coaches. Well, we backed down there probably ten miles an hour, and the brakeman, in order to keep warm, got in the smoker where there was a heater. He didn't get in the baggage car, and he walked down to the car last on where he wanted to couple-up and he was giving signals from this car, and of course, I took it he was at the end of the train and I come down rather close, and when I see

that he was not where I supposed he was, and my brakes was tight or froze up with snow and ice, and I pulled her over and gave her steam, and instead of staying over there she flew back and I went into the baggage car (R. 6067–69). It knocked a hole in the water tank of the engine and broke the steps on the baggage car. We had to get another engine.

"Q. Have you observed any condition in the valve gear of your locomotives which has any bearing on the sound of the engine exhaust or the effect on whether the valves are beating out?

"A. Yes, sir. Just last week I had a case of the engine being reported power reverse creeping, because it gives it a lame sound, and this was the link block pin was wore very badly, and that was the trouble. It wasn't the power reverse, it was the link block pin that was causing this lameness. I brought the engine in that had the valves that were beating out. We reported the link block pin wore bad, causing the engine to run lame.

"Q. Ex. ROGERS. Who was it that reported the creeping?

"A. Engineer Baldwin was one and Mr. Rowe also reported it.

"Mr. MOREHOUSE. Were you on the engine at the time that the valves were beating out?

"A. I brought the engine in; yes, sir.

1715 "Mr. MOREHOUSE. Did you report it?

"A. Yes, sir.

"Mr. MOREHOUSE. How did you report it?

"A. We reported the link block pin wore bad, causing the engine to run lame.

"Mr. MOREHOUSE. You weren't on it when the performance occurred which these other engineers reported, were you?

"A. No, sir.

"Mr. MOREHOUSE. I move to strike the testimony then. This witness can't say what was the trouble with an engine some other fellow was running.

"Exam. ROGERS. You say Mr. Rowe reported the power gear creeping?

"A. Yes; the trip before.

"By Mr. MCLAUGHLIN:

"Q. Well, from your experience would you say that there is anything which may be out of order on the engine which would lead you to think that you might have creeping when in fact you wouldn't have.

(Objected to and overruled.)

"A. Yes, sir. Any lost motion in the valve gear, rocker arm pins, lock box link pin, block pin and all of that have the same effect.

"Q. Have you had any experience with link block pins and out valve bushings in that respect.

"(Objected to and overruled.)

"A. Yes. The valve bushings cut out will cause lameness of the engine, the same effect as power reverse gears creeping. It has

also been reported that the power reverse gear was creeping, and you found it to be in the valve bushings and when they were cut out there was no creeping, and the power reverse had not been touched (T. 6062–6074).

"Q. Have you had experience just one time with the Worthington pump, or have you experienced it generally in checking up on the performance of your engine.

1716 "A. I have made that mistake several times. Now, this was when the power reverse came there in the first place before we had any experience with it. We used to report reverse creeping when it would be found that it would be the Worthington pump or some other cause; not the power reverse. Of course, in late years we have found that was the mistake we made and we don't do that any more.

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. Mr. McHUGH, you had this engine 2515 on a trip on October 17th of this year, did you not?

"A. Well, it was just here a few days ago, I know that; not long ago.

"Q. And you signed work reports on that at St. Paul, didn't you?

"A. Yes, sir.

"Q. And on that occasion you included in the several items in your report this item 'power reverse creeps. Examine the piston packing', did you not?

"A. 2515?

"Q. Yes, sir.

"A. No, sir; if you have got that report there it is a mistake. Is the link block pin there also?

"Q. I will ask you about that in just a moment. I don't think it is the link block. There is something else there I want to call your attention to though. In fact, I have no objection to your seeing a copy of the report, Mr. McHugh.

"Q. Referring you to the copy of this work report that I mentioned, Mr. HcHugh, you see there are two other items there, one reads, 'Pin in right link block worn bad'?

"A. Yes, sir.

"Q. And another one reads, 'Square up valves. Engine very lame'?

"A. Yes, sir.

"Q. And then below those two items is the item that I read

1717 first 'power reverse creeps. Examine piston packing'?

"A. Yes.

"Q. I would like to ask you now after seeing what purports to be a copy of your report, if your present recollection is that you included those three items, all three of them?

"Mr. STEVENSON. We object to this kind of an examination from a piece of paper that counsel presents. Do you sign your work reports?

"A. Yes, sir.

"Mr. STEVENSON. Is that signed by you?

"A. Well, it is signed here, but, of course, not by me. I sign reports when I make them.

"Exam. ROGERS. Do you recall making a work report to this effect?

"A. Why, I possibly reported the power reverse. I wouldn't say I did not, but I know positively that I did not in the last year in the power-reverse, except last winter. Once in a while in cold weather we have a little trouble with the power reverse, the ice getting in it, the same as the link block pin. There is no other trouble.

"Exam. ROGERS. Do you have any doubt in your mind, Mr. McHugh, about having made this work report?

"A. No, I don't.

"Q. You had 2516 on about the 5th of April in the present year, did you not?

"A. I might have. I couldn't say positively.

"Q. Isn't it a fact that on that day you reported on that engine at St. Paul, 'Power reverse sticks on center when running in forward motion?'

"A. I couldn't say to that.

"Q. You have had that experience, haven't you?

"A. Never did as I know of.

"Q. Power-reverse sticking in center?

"A. I don't remember of having that experience.

"Q. You don't care to testify you didn't make that report, do you?

1717 "A. No, sir; I may have done it, but I say I don't recall of having any trouble with the power-reverse sticking on center.

"Q. Do you have with you any memorandum showing the trips you have made during the past two months, or any memorandum of the work you reported on the engine?

"A. No, sir.

"Q. You didn't make any personal record of that?

"A. No, sir.

"Exam. ROGERS. We understand he did make this one observation during the period he said.

"Mr. MCLAUGHLIN. You said during the last three months.

"A. That would be only on the power reverse.

"Q. I meant other than this one period you mentioned. What period of time did that cover?

"A. From the 25th of September until the 10th of October. I think somewhere around there.

"Q. So that that stopped short just a week of this work report I showed you a little while ago, October 17th, is that correct?

"A. Yes, sir.

"Q. In order to call it specifically to your attention, didn't you include in your work report signed September 14, 1931, at St. Paul with respect to that trip on engine 2514 the following notation, 'Tighten union nut to power reverse pipe top of running board front end.'

"A. Oil leaking; yes, sir. I reported that. That was the supply pipe to the air-reverse. I know that."

Engineer McHugh stated on May 14, 1931, he signed a work report at St. Paul, which included the notation: "Oil power reverse." I couldn't say as to the specific day in May, but I know I have reported that notation numerous times; a great many times. The purpose of reporting that is that the cup in which the oil is put into the power-reverse is out on the running board and in order to oil that we have to climb that, and this power reverse cup has got a valve underneath to keep the oil from going in through into the
1719 power-reverse while your engine is standing in the house. As soon as we report it, it is filled in the house. If the cups were not filled and the air-reverse was not getting enough oil the effect is to make it dry, that causes a blow by the piston that results in creeping.

"Q. On August 18, 1931, do you recall whether or not you made a work report on engine 2513 in which you made this notation; 'Top of right stoker elevator rubbing on power reverse brace.'

"A. I made a report like that. I made report several times for them to fill the cup. That is their business to do it. Sometimes they didn't do it.

"Q. Do you recall during the month of August, 1931, on engine 2513, August 6, making this notation on your work report signed at St. Paul. 'Run drip pipe through deck of engine, as steam and water in cab from power reverse.'

"A. I don't remember making that report now. There is no steam to the power reverse pipe in the cab. It works by air. That turned out to be caused by a stay bolt at the side of the fire box. On engine 2514 we had a leak by the steam box by the side of the boiler. It was a stay bolt. There is a drain cock or drain port at the bottom of the power reverse mechanism, one on each end. It works by air. There is no steam connected with it at all unless something happens to the air pump. In my direct testimony in speaking of the power reverse freezing up or working hard I referred to when it gets from 25 to 40 below zero and it is pretty cold and ice accumulates from moisture and fills up the air supply pipe. Once in a while you get ice in there. It happened on engine no. 2512. It did not freeze clear up but it didn't function right. There was not enough air getting through to give it the necessary power. It would take a longer time and your engine wouldn't do what it should. Engineer McHugh reported May 26, 1931, in regard to engine 2514 'power reverse bracket is loose on boiler head.' Also February 21, 1931, on engine 2517 'air pipe broken or loose where

it screws into the power reverse.' On June 7, 1931, on engine
1720 2514 'put double straight nipple pipe in where pipe screws into power reverse.' On January 4, 1931, on report of engine 2514 I made this notation 'put oil cup to reverse gear inside of cab.' I did that so I wouldn't have to climb outside on the running board to fill it. In case the power reverse is not getting enough oil when the locomotive is running there is apt to be leakage around the piston packing and any leakage from the power reverse is what causes the creeping. It is the leakage from the piston or piston rod packing, or any lost motion from the quadrant to the power reverse. There are several pins and any little slack in them pins will cause the power reverse to creep.

"Q. This other occasion that you spoke of when you were using a hand lever for braking purposes, you stated, I believe, you did it many times, but that is the only time when you had any trouble?

"A. Yes, that is the fact.

"Q. During your long period of experience you have used the Johnson bar a good many times for that purpose?

"A. Oh, yes. I guess every man has.

"Q. And it is effective to control the speed of the engine, is it not?

"A. It certainly is. It is good to retard the momentum the other way. That is the idea. The power reverse has the same effect. On the occasion at Huron, South Dakota, I was backing with a light engine and was very close (probably ten feet) to the end of the car to which I was going to couple. I set the air, but everything was froze up, snow and ice, and it didn't affect it, so I throwed it over and gave her steam. I was then going about seven or eight miles an hour. I brought my lever over in time so I would have stopped, but it didn't stay there (R. 6091–92).

REDIRECT EXAMINATION

Engineer McHugh stated that during the period from August 25 to October 7 he made 8 round trips on engine 2514 and 7 round trips on engine 2513; that both of those engines are equipped with
the type of power reverse gear known as the Ragonnet. He
1721 also stated that an investigation was made of the accident at Huron, S.Dak., in 1914 caused by the hand lever flying back and that as he now remembered disciplinary action was taken by giving him 15 days off.

"Exam. ROGERS. What were the grounds?

"A. Because I did not stop and hit him, I guess; because I struck him and done the damage. I should have stopped before I got there (R. 6094–95).

"Referring to these work reports which I have just been asked about in cross-examination, and during the last year, the power reverse has crept at some times. My report would show it, of course.

As a rule it don't bother any, and we never lost any time. I can't recall having the power reverse creep in the last year.

"Q. Then none of these reports which you made in the last year and about which Mr. Morehouse asked you related to a condition which caused the creeping of the gear?

"A. Yes, sir (R. 6095–97)."

RECROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. Don't you know, Mr. McHugh, that any amount whatsoever of leakage which permits air to get out from either one side or the other side of that power reverse in that power reverse cylinder which will change the equalization of the air pressure on the two sides of the piston and result in the piston moving to some extent?

"A. There has got to be a large enough amount to do that. A small leakage won't do it. That will not cause creeping unless it is a large amount, large enough to do it.

"Q. Suppose your small leakage lets air out of there continually over a period of 5 minutes and suppose you lose two pounds of air on one side so that you have got 108 pounds of pressure on that side as against 110 pounds on the other, don't you think that will move the power reverse?

"A. It is connected direct to the reservoir and is pumping into the reservoir all the time. The pump will supply a whole lot
1722 of air. It is not my understanding that the connections between the pump and the air reverse cylinder are open at all times, even with the valves operating, and that the valve admits air into the reverse cylinder when it is closed. My understanding is the air from the main reservoir is opening at all times to the power reverse cylinder and the pump is pumping air into the main reservoir.

"Q. What is your idea of the condition of that valve when the air reverse mechanism is set at a fixed point?

"A. It is equalized.

"Q. Is the valve closed or open?

"A. The valve is open. That is, open to the cylinder. If you move your lever in the cab, that is the same as the air brake lever, or an air brake valve that moves the port valve enough so this front port, or whether you want to reverse your engine with until you stop your lever, and that stops the air flowing and equalized.

"Q. After you stop and your valve is closed and no more air can get into the power reverse cylinder, can it?

"A. No more air can get out.

"Q. No more can get in?

"A. It simply has to get in to equalize.

"Q. Your idea is then that the air can flow in from the supply pipe to the air reverse into the cylinders in the air valve when the air reverse cylinder is closed?

"A. When you are at rest.

"Q. When it is at rest?

"A. Yes, sir. There is a slight amount of air there (R. 6098–6100)."

RALPH R. DAVIS testified:

DIRECT EXAMINATION

Mr. Davis stated that he lived at Breckenridge, Minn., and that he has been an engineman on the Great Northern since September 1897, and that at the present time he is an engineer on Nos. 3 and 4 between St. Paul and Breckenridge and runs opposite to Mr. McHugh and Mr. Rowe. He stated that with the exception of four months during the past year he has been running mountain-type locomotives of the 2500 class. During that time I have observed the amount of fuel I use in that run and the variations that may come from
1723 time to time. Over objection of Mr. Morehouse Witness Davis stated that strong wind, cold weather, bad flange, or because of snow or slippery rails covers the causes of increased fuel consumption and that he had not noticed any increase in the amount of fuel consumption due to the operation of the power reverse gear. I have a case where I reported the power reverse creeping. There seems to be a question as to whether it was creeping. I reported it as creeping because it was my opinion that it was creeping at the time. I arrived at that opinion because of irregularity of exhaust. The irregularity of the exhaust was not pronounced enough on that occasion that I noticed any difference in the fuel consumption. I don't personally know what the trouble was, nor whether anything was done to the power reverse when I reported the creeping.

"Q. That was the only occasion you have in mind during this year about which I have asked you when you had any occasion to question the performance of a power reverse?

"A. The only occasion (T. 6091–6104)."

Engineer Davis stated that before he went on this passenger run that he was engaged in local freight service between Breckinridge and Wilmar, and part of the time tied up at Morris, and that when he first went on this run they used the prairie type and later on were given the mountain or Mikado type locomotives. Some of these locomotives were equipped with hand reverse gears and others with the power reverse, the Ragonnet power reverse. I had a great deal of switching to do at different stations. At Benson, Minn., I have switched as high as 5 hours and on one occasion I switched six hours.

"By Mr. MCLAUGHLIN:

"Q. Do you have any period in mind when you operated a particular power reverse engine on that local freight run?

"A. Yes.

"Q. What period is it and what locomotive?

"A. Well, the exact year, I don't know as I could give you the exact year, but I did have engine 3063, a Mikado engine, for about one year on this local regular.

"Q. During that time do you recall any instance in which the locomotive consumed more coal than usual on account of any action on the power reverse gear?

"Over objection of Mr. Morehouse the witness answered 'No.'

"I have operated the following mountain type passenger engines during the period about which I testified: Nos. 2527, 2515, 2512, 2513, and 2514. These are the same engines that Engineer Rowe operates with the exception of the 2527.

1724 "Exam. ROGERS. Mr. Rowe testified, Mr. Davis, that he had the creeping about one-third of the time on his engine at the present time, that is, he testified on June 24th that about one-third of the engines he had then crept. What is your experience as to that? Do you have one-third of them creep or not?

"A. No; I haven't had one-third. The only engine that I ever had that I supposed crept was the 2514 that one trip.

"Exam. ROGERS. That is, you only had one instance where Mr. Rowe said at present, of course, that was along in June, about one-third of his were creeping; is that correct?

"A. Same period."

CROSS-EXAMINATION

Referring to Engineer Rowe's testimony on June 24, 1931, to the effect that he has creeping on about one-third of his engines at present, I was not in the engine service from January 1st to May 1, 1931. I was on a leave of absence. From May first for a few days I was on 9 and 10, which has a smaller engine. Then I went back to this run that Mr. Rowe is on, the Oriental Limited (trains nos. 3 and 4), about June 10th, and have been on that run since until the present time. The occasion that I recall on this run when I had the power reverse creeping was about August 23, 1931, and I would say I signed a work report at St. Paul on that date—engine no. 2514—in which I reported either "renew air reverse packing leather. Reverse creeps", or "renew air reverse piston packing." I am not sure exactly the words I used, but in any event I made a report on or about that date, and that was the time I recall having observed the creeping.

When the witness was shown what purported to be a copy of a report on engine 2512 on June 18, 1931, at St. Paul, containing a notation reading: "Pack piston air reverse cylinder." He said: "That would be right. That would be a correct report and I undoubtedly made it." He stated it would not be for the purpose of eliminating the creeping but to take up the leak. He said: "We report on piston rods the minute they commence to leak slightly, and a slight leak at the piston rod won't cause that engine to creep. It won't creep enough so that the keenest ear could detect the difference in the exhaust."

"Witness' attention was called to another copy of work report referring to engine 2512, dated June 27, 1931, bearing the notation

'pack air reverse piston rod.' He said: 'That is a proper report, and I undoubtedly made it. I don't remember it. I take it for granted it is.' Witness stated he made about six trips in the month of May, and about ten trips in the month of June" (R. 6109–14).

1725 W. H. MIDDAUGH testified:

DIRECT EXAMINATION

Witness Middaugh stated that he lived at Jamestown, N.Dak., that he first entered the engine service of the Northern Pacific September 3, 1890, and was promoted to engineer September 3, 1896; that he is now in main line passenger service between Jamestown, N.Dak., and Mandan, N.Dak. We have three classes of power, that is, the 2-6-2, the mountain type, 4–8–4, and the class A locomotive, the latter class weighing about 260,000 pounds on the drivers. This class was placed in service January 1926, and is equipped with the Franklin precision reverse gear. When we first got those engines they would go from Jamestown to Glendive, Mont., 326 miles. Over objection of Mr. Thom, Jr., the witness stated that this tractive power now runs from Jamestown, N.Dak., to Missoula, Mont., 904 miles. My road foremen at Jamestown, who have supervision over these engines, are J. C. Murphy and W. B. Wicks. We have an extended run work report taking in the entire territory, a long sheet with spaces provided for each engineer operating those engines. There are seven engineers that operate the engines the 904 miles. I am at Jamestown at the easterly end of the tour those engines make. It is my duty to turn that card into the work foreman, and in addition add whatever defects I find on another form, together with the boiler pressure, the condition of the water gauges, water glass tops, and other parts of the boiler, and the engine in general. I think the extended run work reports have been used over ninety days or maybe four months. During the time this form has been used I do not know how many reports I have turned in respecting work on power reverse, but I would say not many. As to the amount of fuel consumption one of our factors is the difference in the grade of coal taken from the mine. One car will be loaded with a very good grade of coal, and another will be loaded with a grade of coal containing a great many less heat units per ton, making a variation. Another condition would be with the boiler. It is necessary on the last lap of this 904-mile run to relieve the sediment more often with the blow-off cocks than it would be where an engine is fresh out of the shop going the other way. Our permanent instructions are to open those blow-off cocks each 25 miles. Wind conditions make a difference; also the number of stops is another thing.

Over objection of Mr. Morehouse the witness stated that the variation could be roughly estimated from 1 to 3 tons over the division according to the wind. He further stated that in cold weather

1726 they use more coal on account of the heat in the train, and cars move harder in the wintertime than they do in the summertime (T. 6114–6124).

"Q. Have you observed in recent years with this power whether there is any variation in fuel on those runs due to improper performance of power reverse?

"A. No; I haven't.

"Exam. ROGERS. Have you had any improper performance of the power reverse?

"A. That is it. I am not in position to say that I have because that reverse has performed normally in my case. You can maintain proper cut-off where you want it and have your speed at the required speed to make up time.

"Exam. ROGERS. You haven't had a case where you can do that?

"A. I haven't had a case. We have made running time or better.

"Exam. ROGERS. Then you don't know whether a difference in the performance of the power reverse gear would make a difference in the fuel consumption or not, do you?

"A. Our records show they functioned perfectly and handled our trains perfectly and our work with economy.

"Exam. ROGERS. You say they do do that?

"A. That has been my experience.

"Exam. ROGERS. All of the time?

"A. I haven't had a reverse gear failure that I can recall since those engines came in when they have been in my charge since 1926.

"Q. Have you observed a variation in the travel of the cross head at the forward end of the power reverse as much as one-half inch backward and forward?

"A. You can't observe that. We are a hook-up, very long, and when you are in a cab you can't see that. We do have a pressure control gauge that tells whether your engine is working. The spread of those hands tells just the same as your watch tells you what time it is, just exactly what you are making on cut-off. If you can't maintain that spread with those two hands right in front of you, plainly lit up at night, without variation, your cut-off is not varying, even though you do get that flash.

"Exam. ROGERS. I understand the question to be whether you have noticed any difference in fuel consumption due to the performance of the power reverse, that is, when you had a power reverse that was working properly on one trip and how much coal you would burn as compared with another trip where it was not working properly, and I understood you to say you wouldn't notice any such difference.

1727 "A. I haven't had the variation due to the fact that this spread on the pressure gauge hasn't varied back and forth. If you get your engine to a very short cut-off, those two hands come together.

"Exam. ROGERS. My point is you are not in a position to say whether an improperly working power reverse gear increases fuel

consumption or not, because you have not had the improper working power reverse gear?

"A. I haven't had it (R. 6127-28)."

CROSS-EXAMINATION

All of the 2,600 class A locomotives are equipped with Franklin precision type of reverse gear and when I say I have had no failures in power reverse since 1926, I mean I have never had to change an engine during that period on account of reverse gear. I haven't been in a position to observe to what extent, if at all, the piston in the air reverse cylinder creeps or moves back and forth from the cab. It would be necessary to get down and lay on the running board. I make my observations from the sound of the exhaust and the fact it maintains an even exhaust and the way the engine handles. In other words, if an engine would creep down you would get a lounder exhaust gradually increasing the sound of the exhaust. On one occasion I had an accident and the reverse gear went down. I hit a five-ton International gravel truck and a trailer going at 60 miles an hour and threw the gravel truck around into the reverse gear, into the Baker valve gear on the left side and broke the bell crank and tore off the eccentric crank arm. That had a tendency to pull the reverse down. It was a rocking action. It turned back and forth without making a complete revolution.

"By Mr. MOREHOUSE:

"Q. You happened to have some occasions during this time when the gear, when the reversing gear didn't hold the valve motion at exactly at the point where you put it?

"A. Only in a defect such as out valve bushings, or an accident that I spoke of, and where there is a defect in the engine or where there is something broken.

"Q. Or some defect in the reverse gear itself?

"A. The only thing I ever had was leakage by the piston. I think I have reported one not so long ago equalizing.

"Q. Yes; that was reported on October 7th, engine 2603?

"A. I am not in a position to say what date it was; not so long ago.

1728 "Q. Reported at Jamestown?

"A. I report all my work there.

"Q. This was on engine 2603?

"A. We run all the engines. They are all pooled.

"Q. What did you report on that occasion?

"A. Well, I wouldn't swear as to what I reported, except I remember it was air equalizing in the reverse gear cylinder, or something along those lines.

"Q. That is exactly what this report shows that I have here, Mr. Middaugh, and what is the effect of that on that occasion?

"A. The engine worked very hard. It was not easy to reverse the engine and it handled hard.

"Q. Now, on such occasions as you mentioned where you had some leakage past the reversing gear piston, what effect did you notice on those occasions, if any, in connection with the operation of the locomotive?

"A. The reverse gear would stay where I put it.

"Exam. ROGERS. How do you know that you had this equalization?

"On account of having to handle it, as you might say, as a screw reverse without the assistance of the air.

"Exam. ROGERS. Would it make any difference in the handling of the engine?

"A. That is the way I figured the defect, but I never followed that report up or any other to find out, and I couldn't say without looking at my records whether I had that engine since or not.

"Exam. ROGERS. What I meant was would that equalization move the valve gear in any way?

"A. No; it doesn't have a tendency to take away your assistance, the way I reasoned it, and you had to handle that as you would if your air was not on there.

"By Mr. MOREHOUSE:

"Q. That equalization is a different thing from this leakage around the power reverse piston?

"A. The leakage, if it is great enough, will equalize, as I understand it, and it takes away your power reverse gear assistance.

1729 "Q. Isn't it your understanding that a leakage from one side of the power reverse piston will, instead of equalizing the pressure, will tend to make it greater on one side than the other?

"A. If it don't equalize it would, but if it equalizes I don't know why it would.

"Q. In order to equalize you would have to move the pistons?

"A. You would have to move them.

"Q. You have to move the pistons so as to take the valve off center?

"A. Yes; that is not creeping. It stays where you put it while it is equalizing."

1730 S. M. WILSON testified:

DIRECT EXAMINATION

Witness Wilson gave his residence as Missoula, Mont.; that he first entered engine service of the Northern Pacific May 25, 1900, and that he was promoted to engineer October 21, 1904. He stated that at the present time he was engaged in passenger service with the 4-8-4, 2600 class A locomotives, and that sometimes they used the 25 and 26 class power. He was running from Missoula to Butte, Mont., up until April 12, 1931, and since then has been running to Helena. Missoula is the home terminal for class A power which comes in from Jamestown. I know engineer R. R. Slossom who runs into Butte,

and there was a time that Mr. Slossom used to take one of the class A engines from me on no. 2. No. 2608 is one of these class A engines.

"By Mr. McLAUGHLIN:

"Q. To what extent, Mr. Wilson, have you observed creeping on these engines?

"A. There has only been one time that I noticed an engine creeping.

"Exam. ROGERS. Out of how many trips, Mr. Wilson?

"A. That is since September 7th.

"Exam. ROGERS. Of this year?

"A. This year, from the 7th of September until the 28th of September.

"Q. Well, what about before that? How long have you been operating the 2600's?

"A. I have been operating them for the last three years.

"Exam. ROGERS. How often have you seen them creep?

"A. But I made a record of it from the 7th of September to the 28th, and during that period I only had one of them that crept."

"By Mr. McLAUGHLIN:

"Q. That was a written record, and what the examiner wants to know is your experience generally as to the extent.

"Exam. ROGERS. During this three years?

"A. During the three years the performance of the gear has been good. I have never had any trouble in maintaining the desired cut-off and never have I had the wheel throw the latch out
1731 and go down to the corner or anything like that. It always stayed where I put it.

"Exam. ROGERS. Have you had them creep from time to time during this three years or not?

"A. Just the once that I can remember of."

(Mr. Morehouse moved to strike the last two questions and answers on the ground that same was not proper rebuttal, and goes to the allegations of the complaint that the power reverse gear has been developed as practical, suitable, and safe to use, and applicable to all steam locomotives.)

"Exam. ROGERS. I want to get Mr. Wilson's idea of how frequently this creeping occurred as compared with Mr. Slosson's answer that it occurred about every trip."

"By Mr. McLAUGHLIN:

"Q. To what extent did the gear creep on this trip you refer to in September?

"A. In starting out of Missoula after I started hooking the engine up after we obtained a speed of possibly 20 to 25 miles an hour I didn't latch the gear wheel and it started going down, and I left it down and latched it and held it there for several miles and then I turned it back again and put it up where I wanted to leave it and it was all right. I had no more trouble with it. It stayed there.

"Q. Did you ascertain what the difficulty was when you first noticed that condition?

"A. It was dry valves.

"Exam. ROGERS. Dry engine valves?

"A. Yes, sir.

"Q. What did you do about the dry valves?

"A. Just let her work with a longer cut-off until the automatic lubricator had a chance to lubricate the engine, and as soon as she got lubricated she was all right.

"Q. Was that apparent in your judgment sufficient to make any effect, any appreciable effect on the amount of coal used?

"A. None."

CROSS-EXAMINATION

"Q. How did you determine that the valves were dry on that occasion?

"A. Because we got a jerk on the wheel. You could take
1732 hold of it with your hand and you could feel the wheel, the pull on the valves on the gear. It went down slow, just creeping. I pulled it back to where I had it and it started going down, then I decided it was the valves. I first left it there and latched it and let it run along a few miles.

"Exam. ROGERS. Have you ever seen the wheel move when it was not latched, outside of this one occasion?

"A. Well, a little bit, kind of having a tendency to move a little. It would be wabbling maybe. It would not make a complete revolution."

"By Mr. MOREHOUSE:

"Q. You made particular observation as to this question of creeping for the period that you mentioned from September 7th to September 28th, didn't you?

"A. I did.

"Q. Outside of that period you never made any particular observation or kept any particular track of it?

"A. Just only as I remember it.

"Q. And you say you cannot recall now any other instances, but you do not mean to say by that you never had any other creeping at any other time?

"A. Not that I remember of."

During this test period I made 21 single trips between Missoula and Helena. The time that I had the difficulty with the reverse gear was on the trip of September 17 with engine no. 2605.

JOHN I. WAY testified:

DIRECT EXAMINATION

John I. Way stated that he was a resident of Baltimore, Md., and has been a locomotive engineer on the Baltimore & Ohio for 42 years and that for the past 32 years he has been in passenger service

and is now running between Washington and Jersey City; that he operates no. 522 from Washington to Jersey City and no. 25, the Fort Pitt limited, from Jersey City to Washington, and has been handling those trains since 1926. He is operating the P–7 President class of locomotive which weighs 201,000 pounds on the drivers. They are equipped with the Alco and Barco reverse gears. He has been running this P–7 type of locomotive since they came on his territory which was in 1927. My record for on time performance is about 98%. These President engines are the same engines that Engineer Ward ran when he was in service.

1733 We have a maximum speed between Washington and Philadelphia of 70 miles an hour, a maximum on the P. & R. of 80, a maximum on the Jersey City Central of 70, but I have a run of 225 miles and 4 hours and 38 minutes to make it in with 11 stops. I am most always a little bit shy and at places where I can I recover and sometimes stretch it up a little over 80. It is necessary for us to maintain an average speed of 46.5 miles an hour. It is therefore necessary while we are moving to get up as near 70 as it is possible to do and stay there while moving.

As to whether I have had any difference in the fuel consumption due to the different action of the power reverse, I will say no.

"Mr. McLaughlin. Mr. Examiner, on page 1810 of the record the Witness Ward testified that he has operated Ragonett, Alco, and Barco gears and has not seen any that do not creep. Now, with that testimony in mind I want to ask you, Mr. Way, whether you have operated engines, the same engines that Engineer Ward operated?

"A. Why, yes, I suppose so; although I was in this service a long while before Ward came into it. Ward has just recently been in this service, that is, since it was established between Washington and Jersey City, and we had the P–5 before that and I operated all them all the while they were on."

I can say I have operated all of the P–5 and P–7 locomotives and have also operated engine 5320, which is a P–9A, but I operated the 5320 on October 21st and 22nd this year. Before Mr. Ward's death I did not have the 5320 very often because it was assigned to the Capitol Limited, with three men running it, and we seldom got her. I have occasionally run her off of her regular run.

"Q. Now, have you ever observed any creeping on these locomotives, and if so, to what extent?

"A. No, sir; I have not. I took particular notice of the 5320 the other day when I got her and run her, and since I found out I had to come down here, why, I made a little notation of several, 5308 and 5320 and 5307 and 5318 (T. 6134–6150)."

I would like to state in my own way the failure with the power reverse on one of these locomotives. The condition was the power had went out of the corner and reversed itself, knocked the head out of them, and I imagine it was the Barco bar. It knocked the head out of the screw cylinder of the Barco bar. When the Barco Com-

pany heard this they sent some representatives on the ground
1734 to make an examination. Mr. W. E. Cavey, our supervisor of locomotive performance at that time, was there. The Barco people claimed that the bar couldn't creep, that with a combination and screw bolt that the bar couldn't creep, that wherever you put it that is where it stayed put. On that trip out of Washington Mr. Cavey rode with me to Baltimore and on the way he said, "John, if that is necessary, why have they got the spring in the thumb latch?" I replied, "I don't know, but it won't be long until I find out." When our speed reached about 65 miles an hour outside of Washington I unlatched that bar and tied a string around it and held it there unlatched, and it never moved. It stayed put where I put it and unlatched.

Now, I will say again that I have tried the same thing since. I tried it the other day on locomotive 5307. It would go down just a notch at a time. That is all it would go down, but it would not stay out. I had the 5308 the other day and I called my fireman's attention to the bar and how nice it looked. I just took two fingers and held them on top of the bar and unlatched it. I didn't let go of it. Probably the pressure of my hands held it there, but I didn't put any pressure on and it stayed where I put it. That is my experience with reverse gear creeping. I would say that they wouldn't stay unlatched and stay in place. When I took the string off and latched the gear of which I was speaking the gear performed 100% (T. 6147–6152).

CROSS-EXAMINATION

I wish to state that the power reverse gear on engine 5320 is the new improved Barco.

"Q. Your statement with respect to not observing any difference in the fuel consumption is based on the fact that so many different factors enter in that you feel you are not able to definitely say what effect, if any, the power reverse gear had on it?

"A. I would say that yes, because we are using on that class of locomotives various sized nozzles. At the present time we are trying to eliminate the smoke as much as possible and for that reason are using the various sized nozzles. By nozzle I mean the exhaust steam at the front end. As an illustration I came to Baltimore with 11 cars and engine 5307. The road foreman got up on the engine and the first thing he did was look at the tank and said, 'How many cars have you got?' I said, 'eleven.' He replied, 'This engine isn't burning much coal, is she?' (T. 6144–6154)."

1735 JOHN T. MILLER testified:

DIRECT EXAMINATION

Witness Miller stated that he lived at Irvington, Baltimore, Md., and that he has been running an engine for the Baltimore & Ohio since January 29, 1906, and that he has been in regular passenger

service going on five years and runs between Washington and Jersey City operating the P–7 president type locomotive. I knew Engineer Ward who testified in this case, and have operated the same locomotives he operated. I have had experience with Engine 5320 since it had the late type Barco gear. As to my experience with the power reverse creeping I will say I don't know when I had one to creep. I don't believe I have had over one this year. I might have had one that I thought crept. With these trains I make 70 miles per hour on the B. & O., 80 on the P. & R., and 70 on the Central. I have not been delayed on account of any difficulty with my power reverse at any time. As to the engine which I thought was creeping there was a difference in the sound of the exhaust, one exhaust was a little stronger than the other, just a second or so. The irregular exhaust did not continue long. I didn't notice it any more than a mile or less. The engines that I operate of the P–7 class are equipped with either the Alco or Barco gears.

CROSS-EXAMINATION

"Q. There was just one occasion when the gear did that, after going down and making the exhaust unequal did it afterwards come back and make the exhaust equal again?

"A. Yes. I didn't touch the lever it went down and back of itself. It did that about a mile or three-quarters, something like that, and only about twice on the whole trip, and that wouldn't make any difference in the coal consumption."

J. P. MEAGHER testified:

DIRECT EXAMINATION

Witness Meagher stated that he lived at Evansville, Ind.; that he was an engineer on the Chicago & E. I.; was hired June 18, 1899, and promoted in June 1907; that at the present time he is running in freight service and operating the Mikado type locomotive.
1736 They are all 2–8–2 engines with stokers and power reverse gears, and some are hand power and some manually operated gears. From nos. 1925 to 1939 were equipped originally with Ragonnet, but some have since been changed to Alco gear. Engines 1940 to 59 were bought equipped with Alco gears. The weight on the drivers of these three classes are substantially the same, 220,000 pounds, but it varies a little. My run is between Evansville and Danville, Ill. That is the territory over which Mr. Tesch has jurisdiction as road foreman, and he has jurisdiction over these various engines that I have just classified and which I have operated. I have had experience operating engines of the class from 1925 to 1939 which are equipped with Alco gears and also those numbered 1940 to 1959 which are likewise equipped with Alco gears. On those engines I think in the last fourteen or fifteen months I have had about

four or five runs that was creeping on me that I reported. There were several of those trips I had with the gear creeping, and it was necessary for me to drop the engine down. There are various conditions which would bring about a variation in the amount of fuel used, namely, weather conditions, kind of coal, whether a high wind, or a frosty rail. Those things will cause you to use more coal and also if the gear would be creeping it would cause it. As to the extent that variation in wind would cause the variation in coal, I never experienced it (T. 6154–6164).

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. Those cases that you refer to where you reported the gear, reverse gear creeping, were on the engines with the latest type Alco gear?

"A. I think there was some of both kinds. I recall making a verbal report to Mr. Tesch on August 3, 1931, with respect to creeping on engine 1938. As that engine was going through I didn't make any report on it. At certain terminals we do not make reports because the engines go through. On my northward trips they all go through. That is, half of the time. Once I had the experience with the reverse gear creeping to the extent it came back of center. The engine reversed itself and I was working about a 25 percent cut-off when it happened and the reverse went to the back corner. The engine acted to me just like an engine slipping very badly. The locomotive was equipped with a Ragonnet. I reversed the engine back
1737 and from then on had no more trouble with it. We were going about 40 miles an hour. It came back all at once. I went another 137 miles after it happened and I noticed nothing wrong with it at all and I worked at the same percentage of cut-off after that."

REDIRECT EXAMINATION

"By Mr. MCLAUGHLIN:

"Q. Was there any damage done to the engine or equipment on that occasion when this engine reversed itself?

"A. None whatever."

JAMES MCKEANEY testified:

DIRECT EXAMINATION

Witness McKeaney stated that he lived at Philadelphia and was first hired as an engine wiper by the Reading June 4, 1887, and was promoted to various stages until he became an engineer September 9, 1897, and that he has been running an engine for about 34 years. He stated that he was now in passenger service between Philadelphia and New York and that they make a speed of from 80 to 85 miles an hour. He stated for the last 15 years he had operated locomotives

equipped exclusively with power reverse gears. Over objection of Mr. Morehouse the witness was allowed to state that he never found creeping enough to make any difference in the consumption of fuel. Our engines with the power reverse are well kept up, and we have very little trouble with creeping. Our engines are equipped mostly with the Ragonnet and Alco power reverse gears. We have creeping once in a while. The gear will drop down a notch or two. You will have a little difference in the exhaust, a little louder for just a short time, and then it will go back into place. In my experience there has been no trouble with it. Of course the operating lever in the cab doesn't move. I am just speaking of the link motion. It may occur once on a trip or once a month. I cannot recall of its happening more than once on a trip. I have been local chairman of the Brotherhood of Locomotive Engineers in the territory in which Mr. Dampman works since 1903. I am familiar with the engines used by my company in the territory in which Mr. Dampman works. I am familiar with the design and have seen them. I have run the same class of engines that he had on the Bethlehem run.

1738 "Q. Mr. Dampman testified that on oiling up it was necessary to put his head around the radius bar and to put it in the way of a radius bar. What is your experience with reference to that?

"A. I never had to do it on those engines (T.6164–6174)."

"By Mr. McLaughlin:

"Q. Mr. McKeaney, did you ever experience the link block moving in the link when the engine was standing near the roundhouse or on a dead track?

"A. No; I never had that observation.

"Exam. Rogers. What are your views, Mr. McKeaney, concerning what the other witness was testifying about as to whether there is a liability of being injured when you are oiling around if your radius bar does move?

"A. If it moved enough for them to put their head in the way, why, sure. I keep my head clear all the time, I am not going to take any chances."

"By Mr. McLaughlin:

"Q. What about your arms, Mr. McKeaney, as to whether or not you are able to keep your arms clear of the motion as well as your head?

"A. You will have to reach your arms across the radius bar, but I never know of danger on that, or underneath it to oil certain parts."

CROSS-EXAMINATION

"Q. Of course, if you happen to have your arm in there and some one moved the lever, reversed your engine, you will admit that there would be some danger there?

"A. Most certainly, if someone moved that lever.

"Q. But it is because you never observed the link motion move without somebody moving the lever that you say there is no danger?

"A. Yes, sir.

"Q. About this question of whether or not it is necessary to get your head in the way of oiling certain parts, don't you think there might be quite a difference between men, taking into consideration the different heights, size, and so on?

"A. No, I don't think that anyone would have to put their head in danger to oil any engine that we have.

"Q. In order to get into the springs and saddle to reach certain parts, would a man have to stick his arm in far enough to get his head in the way of that radius rod?

1739 "A. No, sir; he wouldn't even have to do that.

"Q. What would he do, stick his arm in clear to his shoulder and pull his head back?

"A. You have quite a long spout can, as long as you want it."

"By Mr. MOREHOUSE:

"Q. With respect to fuel consumption in connection with creeping power reverse, Mr. McKeaney, do you mean by your testimony to say that you have not observed enough difference to detect it?

"A. I made no particular observation. I never had any complaints about fuel consumption with what creeping I have seen. The fireman generally complains if you are using too much coal. I never run a stoker fire. These are hand fired and they complain mighty quick on the hand fired (T. 6174–6184)."

"By Mr. MOREHOUSE:

"Q. This creeping that you have observed, Mr. McKeaney, if I understood you, it was what you call the creeping, was the action of the valve motion to permit the valve to be adjusted to another point of cut-off and then coming back again to the place where it was before it started to move and that occurs without any movement of the operating lever of the power reverse?

"A. Yes, sir.

"Q. And when you start out with an engine and get to a point on the road where that occurs, you usually find that that will repeat itself a number of times before you get to the end of that trip?

"A. This creeping is generally of short experience when first starting out with your locomotive. Very seldom after an engine gets warmed up and properly lubricated after you start do you have any creeping.

"Q. It is when the power reverse is in perfect condition that it will creep to some extent until the engine gets warmed up?

"A. Yes. I am not speaking about creeping in cases where there is an air leak in the power reverse piston, or any thing of that kind.

"Exam. ROGERS. Do you have such things where there is creeping due to the leak in the air?

"A. Yes; I believe we do.

"Exam. ROGERS. You told Mr. Morehouse that when the power reverse gear was in perfect condition and first starting out you had this creeping; what do you mean by that?

1740 "A. Well, the engine starting out and working hard. The machinery might move a little bit back and forth until the engine warms up and gets going, and after that there is no more trouble.

"Exam. ROGERS. Is that a regular condition?

"A. No; that may happen, we'll say, once out of 20 trips."

By Mr. THOM, Jr.:

"Q. Do you operate in level territory?

"A. It is up hill and down hill between Philadelphia and New York; there are no heavy grades.

REDIRECT EXAMINATION

"Q. As I get it, your testimony about this initial creeping is that condition produced by dry valves?

"A. Yes; until the engine warms up and gets proper lubrication.

"Q. Mr. Morehouse asked you if some one moved the reverse gear while you had your head or your arms in the motion that you would expect to get them caught. Is there any difference as to whether you get them caught in the fact that your engine is power reverse or manual reverse?

"A. Not much. Getting caught either way is bad.

"Exam. ROGERS. Now, that brings up a point that I would like to have your views on, Mr. McKeaney. If a man starts to move the hand gear over and a man down below is oiling around and has his head or his arm in the parts, that when the man in the cab moved the hand lever over to a point where the motion parts come in contact with the man's head or arm that the man in the cab would feel it and stop the movement of the reverse lever, that is, the hand-reverse lever, and thereby eliminate crushing the man's head or arm who was oiling down below. What do you think about that?

"A. Mr. Examiner, I haven't run a hand lever for 20 years, but I don't see how he could find it out on our engines. With the old eccentric a man has got his arm and head in through the drivers, or in between the spokes to oil one of the engines with a hand reverse, and the eccentrics are inside and he has to reach over and put his hands in between the spokes of the wheel, or perhaps back of where the reach rod is.

"Exam. ROGERS. The point I have in mind is whether a

1741 man moving the reverse could actually feel an obstruction of that sort in the valve motion parts in time to avoid the crushing of a man's head or arms?

"A. I don't think so."

RECROSS-EXAMINATION

My recollection of hand-levers and their operation is such that I could not say whether or not the amount of force which moves the valve mechanism is greater with the hand or with the air-operated gear.

"Q. You are rather hazy on the operation of hand levers at this time, after 20 years, are you not?

"A. Yes; I wouldn't say it was 20 years; it is in the neighborhood of 15 years at least.

"Exam. ROGERS. You did operate them for some fourteen or fifteen years, didn't you?

"A. Yes, sir.

"Exam. ROGERS. You have not forgotten how they operate, have you?

"A. Not a bit.

REDIRECT EXAMINATION

"Q. When you are handling the manual bar and you come to a place where it required more force to move it than it had been up to that point, what did you do?

"A. Braced myself and used all the strength I had.

RECROSS-EXAMINATION

By Mr. MOREHOUSE:

"Q. You wouldn't do that if you were standing still and your fireman was down around oiling the link motion at that time?

"A. My fireman never oils it for me; I wouldn't move anything if I knew a man was down there.

"Q. If you started to move it inadvertently and, knowing some one was down there, you felt the lever get to a point where it worked harder, you would quickly stop?"

(Objection by Mr. McLaughlin overruled.)

"A. Yes; certainly, if I thought anyone was there or caught in it I certainly would stop. I have been around engines nearly 45 years and never saw a man injured yet. I never seen an occasion of
1742 that kind happen. I have seen them after they did happen though.

A. J. SEELMAN

DIRECT EXAMINATION

A. J. Seelman stated that he lived at Brookfield, Mo., and that he was first employed in engine service by the C., B. & Q. in 1897. He stated that he was promoted in 1903 and, with the exception of about one year as extra passenger engineer, he has been continuously in freight service since. Engineer Seelman stated that he had run all

locomotives down on that division, 214,000 pounds on the drivers up to 307,000 pounds.

"Q. Engineer Burkhalter from your road testified that the power reverse gear is hard on the fireman's back, the coal bin and water. What is your experience with any wastage of fuel, if you have had any, on account of the power reverse?

"A. I never noticed any difference in the coal pile."

The witness stated that he has had some experience with power reverse gear creeping. The gear would allow the valve motion to travel probably a notch or two. The engine would work harder for a short distance and then he would get the lever and pull it back. It would take a couple of minutes to get her hooked back and this occurrence would probably happen a good many times over a trip.

"Q. Now, on what do you base your experience that you wouldn't have observed any wasteage of fuel under those circumstances?

"A. Well, I never had to stop and take coal where the gear was creeping, where I haven't did it other times."

If we had heavy handling trains it would be necessary to stop in order to take coal. Climatic conditions, cold weather, and things of that kind cause the use of more fuel. Not long ago I stopped due to that reason to take fuel for a heavy handling train. The through freights run on a schedule of about 35 miles an hour. They are heavy trains and going east have about 2,500 tons.

"Q. Do you have any difficulty making your schedule with your power reverse engines?

"A. No, sir.

"Q. When your engines are creeping in the fashion you have described, does that have an appreciable effect on your scheduled time?

"A. No, sir."

1743 CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. Mr. Seelman, when the power reverse is creeping it does have some effect on the speed and the tractive force of your locomotive, the engine at that time works harder, doesn't it?

"A. Well, it works with a longer stroke and valve travel and exerts more power.

"Q. Then if you happen to have an engine where that creeping repeats itself numerous times over the trip, why, you would have just that much more effect on the steam used?

"A. I don't allow the lever to stay down.

"Q. On those occasions did you ever take any particular note of the coal pile or make any test of any kind along that line with a creeping power reverse as against one that was not creeping under similar conditions?

"A. On arrival at the terminal I notice how much coal we consumed, whether it is ordinary or not, and I have not noticed anything

out of the ordinary. The amount of coal used might be affected by other conditions as well.

"Q. From May 22 to September 22, you have reported power reverse nine times, have you not, as shown by these work reports?

"A. That is possibly true, seven of the reports were connected with power reverse creeping.

"Exam. ROGERS. Does that mean you reported seven times out of something like 100 trips in the four months?

"A. Yes; probably that is true."

REDIRECT EXAMINATION

"By Mr. MCLAUGHLIN:

"Q. From your experience in making out reports of this sort, do you ever make it out when the gear is not creeping?

"A. Oh, yes; if I find something else wrong with the gear besides creeping, I report it.

"Q. What is the purpose of making such a report if the gear has not crept?

"A. There may be a small leak that would not effect the working of the gear particularly, but it should not be there.

"Q. When you make out a report for reverse gear creeping,
1744 what is your experience as to whether the Burlington remedies the situation?

"A. They do.

"Q. And how quickly?

"A. The first trip, it has to be fixed.

"Q. Mr. Morehouse asked you a question that in measuring the amount of coal that was used above the ordinary. You would sometimes have many factors that would cause such an excess in any trip. What I would like to ask you is whether you recall any trips where all things were equal, the same tonnage, weather conditions, wind, and other factors and the only unusual circumstance was the creeping of the power reverse?

"A. I don't recall any of them that I ever took coal or paid any attention to it (T. 6194–6204)."

RECROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. About these reports, Mr. Seelman, in checking up, there are five where creeping is clearly indicated?

"A. Yes, sir.

"Q. And there are two involving putting of an oil cup on which wouldn't cause creeping unless the gear go so dry that there was a leakage of air; is that correct?

"A. That is true.

"Q. And there is another one, the tightening of nuts around the reverse gear piston which, as I understand you, you can't recall whether the leak in that case was sufficient to have caused creeping?

"A. No, sir.

"Q. Would it cause it if there was enough of a leak?

"A. If it was heavy enough.

"Q. You always make a report even if there is only a small amount?

"A. Absolutely.

"Exam. ROGERS. That is another trait of the Burlington; I take it?

"A. We were brought up that way, Mr. Examiner."

1745 D. HARTLE

DIRECT EXAMINATION

Witness Hartle stated that he was a resident of Garrett, Ind.; that he was first hired in 1896 by the Baltimore & Ohio as a fireman, and that he was promoted to engineer in 1900. He stated that he was in engine service for 13 years, and that in 1913 he was appointed assistant road foreman, and that on January 1, 1915, he was promoted to road foreman of engines and remained in that position for a little over 11 years or up until September 1, 1926, and that at the present time he is now running an engine. My experience has been in the territory known as the Chicago division with runs from Willard, Ohio, to Chicago, Ill.

When I was road foreman of engines it was my duty to employ firemen and promote engineers. The firemen and engineers came directly under my supervision. I was also required to ride on locomotives and report their mechanical condition at the completion of the trip on a form prepared for that purpose.

"Q. Now, what duties did you have in respect to repairs that you reported on your trip report forms, or reported in any other way?

"A. It was the duty of the road foreman at that time to follow up his work that he had reported and make an effort to get it done, or in other words, to see that it was done.

"Q. What other duties did you have?

"A. We were required to make a joint inspection with the master mechanic once a month on a day set aside and all engines were inspected by the road foreman and master mechanic personally arriving at the terminal where the inspection was made. We were also required to watch the movement of trains to the different terminals, and if there were any unusual or unnecessary delays make a report of same to the superintendent.

"Q. Were you ever called on for any kind of recommendations to your superior officers?

"A. Yes. When new class of power would arrive at the division, after the road foreman had ridden this power he was asked by the superintendent many times to give the superintendent his opinion about it, how much tonnage the engine would be able to handle over the territory. When new schedules were being made he was also consulted in regard to the time that should be made by the

1746 different classes of power handling these trains that were to operate on the new schedules. The superintendent even consulted the road foreman in regard to yard movements of trins, and the handling of engines at terminals. I would receive instructions from time to time from the locomotive supervisor to check the fuel consumed on certain classes of engines by counting the scoops of coal used on specific trips."

"By Mr. McLAUGHLIN:

"Q. I should ask the witness first what type of power he had equipped with power reverse in his territory during the time from 1913 to and including 1926. Give us a general range of the power.

"A. The P–3 class of passenger engines, the P–4 class of passenger engines were all equipped with power reverse gear at that time, and about 75 percent of the power used in yard service was equipped from 1922 up until 1926. There were few, if any, freight engines equipped with power reverse gear during that time to my knowledge.

"Exam. ROGERS. Did you make any observations to determine the question as to whether the power reverse gear would increase the fuel consumption?

"A. Watched that closely from time to time, but I never saw a case where power reverse gear crept to the extent where there was an excessive amount of fuel used that could be detected by observing the fuel pile at the end of the trip.

"Q. To what extent did you observe the engine's creeping?

"A. I have seen them creep lots of times. They would creep if the gear would gradually go down for a notch or two. If the engineer did not make any change and it would revert back, shifting coming and going. It would be just once in a while. We have run engines on that division year in and year out with no trouble experienced due to reverse power gear creeping. We have had other engines that gave us trouble in creeping. I always observe the performance of the reverse gear while riding on the engine, and if the reverse gear was operating properly, a notation was made to that effect on this report that was turned into the round house foreman at the completion of the trip (T. 6204–6214). Those engines that gave us no trouble on the part of creeping were assigned to not more than two engineers. Some of those engineers in the regular service were very particular about the proper maintenance of the reverse gear. They followed up very closely all mechanical defects that would result in the reverse gear creeping, and their influence with the round-house foreman was such that they were able to keep the reverse gear maintained in good condition,
1747 which resulted in the reverse gear functioning properly. It is my theory that good maintenance will avoid creeping. I have never ordered an engine taken out of service on account of power reverse trouble."

"By Mr. McLaughlin:

"Q. Does a creeping power reverse in your judgment have any effect on the amount of fuel used?

"A. It would if the creeping was excessive, and by that I mean, where the engineer would not have any control over the trouble of the valves due to reverse gear creeping.

"Q. Now, to what extent have you observed what you call excessive creeping, and what do you mean by that?

"A. I mean where the engineer would not have any control over the travel of the valves due to reverse gear creeping.

"Q. Have you observed any such conditions?

"A. Not to that extent.

"Q. What are the repairs that you found necessary to be made on power reverse? Summarize briefly.

"A. Excessive lost motion in the pins and connections on the gear itself, in my opinion, is one of the causes of more creeping than anything else. If the gear is not properly lubricated, it becomes inefficient and will not function properly. Piston rings leaking excessively or beyond the capacity of the pump would cause creeping. Also piston ring packing blowing excessive might cause creeping.

"Q. In your experience about the shop and round house, are those items of repair work difficult to accomplish or easy?

"A. At one time some of those repairs were quite hard to be made, and in the earlier days of the power reverse gear it was hard to get the round-house foreman, the general foreman, and the master mechanic to realize the importance of the proper maintenance of the power reverse gear, but I think that has been almost entirely overcome. It was possible for the round-house force to effect these repairs, but sometimes it would require holding the engines for a little time.

"Exam. Rogers. On these worn pins and busings, ordinarily how long would an engine run out of the shop before it would be necessary to renew these pins and bushings, or that the wear would be such that it would affect creeping?

"A. If they are properly lubricated they will run 9 months."

1748 "By Mr. McLaughlin:

"Q. Have you had any experience since you left the position of road foreman that would lead you to have any other conclusion about the fuel question in connection with power reverse than it did while you were road foreman?

"A. No, sir."

CROSS-EXAMINATION

"By Mr. Morehouse:

"Q. Any leak around the power reverse or in the power reverse mechanism will also result in creeping, will it not?

"A. If it was not excessive. Small leaks will not cause creeping. That is my view of it anyway.

"Exam. ROGERS. Dealing with your experience as road foreman, what type of gear were you talking about?

"A. The Ragonnet principally, but I have run a few engines with the Alco.

"Q. The only opportunity you had to observe any creeping during your period as road foreman was when you were riding passenger engines on the road?

"A. Yes. I am pretty positive all the freight engines were equipped with manual-operated gears. The last month I worked as road foreman I made 4,000 miles on the deck of passenger engines. That month I specialized on passenger engines. I didn't do that all the time, but there was hardly a day that I did not ride a passenger engine. We experienced trouble at that time in making time and were trying to keep down engine failures. I was instructed to watch the performance and mechanical condition of the whole locomotive. I would say nearly every day I rode a passenger engine some distance over the railroad, far enough to observe the mechanical condition of the locomotive. I might ride between two stations only, or over the entire length of my territory.

"Q. With the Ragonnet don't you think even though a slight leak will continue for a few minutes with no change in the adjustment of the position of a gear, that during those few minutes it will reduce the air pressure in one end of the power reverse so as to result in the piston in that cylinder moving and thus change the adjustment of the valve motion?

"A. I have seen bad leaks in the piston and still the reverse gear functioned properly.

"Q. How do you account for that when that leak would reduce the air pressure on one side of the piston with the Ragonnet type?

1749 "A. I kind of think that valve is so adjusted that it will supply air without any noticeable creeping.

"Q. Is it your thought then in that sort of condition the air would come into the reverse cylinder through the supply pipe and through the valve to build up that pressure that was leaked off?

"A. Before there would be any noticeable creeping, yes, that is, to any extent. By that I mean so that you would notice it in the exhaust. I have never seen a power reverse gear shift back and forward when standing at a terminal with the air turned on; never seen any shift when the engine is standing.

"Q. Don't you know the Ragonnet type of gear has a valve on it which after the gear is set in a given position covers the port so there is no air goes in or out of the cylinder?

"A. Yes.

"Q. Then it is necessary for that valve to be moved, is it not, before more air can be admitted to either side of the cylinder?

"A. Yes; but it will do it if they are in good condition without any noticeable shifting. There is a slight movement of the valve and a slight movement, possibly, of the piston, but you can't notice it on the shifting of the gear. It is my idea that the piston moves the valve, but I just couldn't tell you as to whether the piston has to move before it will result in moving the valve."

"By Mr. MOREHOUSE:

"Q. Are you talking about the piston moving without any action or any one moving the operating lever in the cab, and in turn moving these valves without any movement of the operating lever?

"A. If you get shifting, yes; it will do it without any movement of the lever. With respect to the effect of creeping on the consumption of coal, I will agree that whenever the creeping goes to the extent that you notice a difference in the exhaust at that particular time you are using more steam than if the gear had remained where it was set."

If the gear would go down and open the admission port in the valve there would be more power exerted but it has been my experience, especially with the Ragonnet gear, that when it shifts ahead if you wait a minute or so it will shift itself back to the same place, and reduces the power. You could hear the exhaust where she would work down and would work harder, may be two or three minutes, and then it would come back where it was, where
1750 the engineer placed her. I have seen them work for 10, 15, or 25 miles; and there would be another slight change like that and I never have seen a power reverse gear shift to the extent where time was lost. I claim this, that whenever a power reverse gear would shift where time was lost it would affect the fuel consumption (T. 6214–6224).

"Q. Don't you think, Mr. Hartle, in performance like you mentioned, where the reverse would creep down and stay a minute or so and come back and then go along several miles and do that again, if that was repeated over the run to some extent you would be using more fuel than if that had not happened?

"A. Theoretically there would, but you couldn't notice it by observing the fuel pile at the end of the trip. You couldn't tell how much.

"Q. No; you couldn't because other factors, such as difference in wind and these other matters that these other witnesses have mentioned might be such that you could not compare that trip with some other trip where there had not been any creeping; is that what you have in mind?

"A. Yes, sir.

"Exam. ROGERS. Mr. Hartle, all the comparisons practically that we have had so far in this case as to fuel consumption went to a comparison on the reverse gear which was creeping with one that was not creeping. Do you think that there is any greater or less—

let us take a power reverse that is in good condition and not creeping on a given engine and another engine of the same class and weight with hand gear. From your experience would you expect any difference in fuel consumption, all other things being equal between the two engines over the trip?

"A. No. The fuel consumption would be the same so far as the reverse gear is concerned. It is my opinion that with the power reverse gear working properly that the engineer can effect a greater nicety or closer cut-off than you can with the hand reverse.

"Exam. ROGERS. Well, my question is in the matter of practical operation—does he do it?

"A. Yes, sir.

"Exam. ROGERS. What would be the result on fuel by this increased nicety that you speak of?

"A. It would have a tendency to be a little more economical on the fuel."

"By Mr. MOREHOUSE:

"Q. I don't quite understand, Mr. Hartle, why you say that a power gear that is functioning properly would be more economical on fuel than a hand lever, and then at the same time you say
1751 that a power gear that is creeping wouldn't be any less economical than one that was not?

"A. My contention was this; that power reverse gears are not permitted to creep to the extent where time would be lost.

"Q. Your idea is if time is not lost very little extra fuel is consumed?

"A. There may be a little extra fuel consumed, but you can't tell it by observing the fuel pile at the end of the trip."

I would like to say, if permitted, in connection with the handling of the two types, that is, the hand gear and the power reverse gear, when an engine is running and gets up to 55 miles per hour in speed if the engine has one of the Johnson bar type or hand reverse gear you are setting up there in the cab and don't know just
1752 exactly the condition of those valves down there and you are a little bit afraid. You say "I would like to hook her up another notch, but she may take me down in the corner." With the power reverse gear it is different.

Mr. Morehouse interposed an objection to further voluntary remarks which was overruled.

"Ex. ROGERS. Finish your statement.

"A. With the power reverse gear you feel free to hook the engine up or let it down at any time, because there is no danger of being jerked. I am local chairman of the Brotherhood of Locomotive Engineers."

R. L. Acker

DIRECT EXAMINATION

Witness Acker stated that he was a resident of Quincy, Mass.; that he was first employed by the New York, New Haven & Hartford in 1907, and was promoted in August 1917. He said that he was in through-passenger service between Boston and New Haven and operates the 4–6–2 Pacific-type locomotives equipped with Ragonnet power reverse gears. Occasionally he operates an older type locomotive, I–2 or I–4 equipped with hand reverse.

I know Engineer W. N. Spaulding in the service from Springfield to New Haven. He uses the same class as I referred to, the I–4 class. I am familiar with track conditions at Providence and Hartford Stations.

"Q. Mr. Spaulding when testifying in this case stated that with power reverse on his run that carries him through Hartford station in passenger service he found that the slack got away from him before he could reverse the engine. Now, have you any points in mind in the territory in which you work where the conditions are substantially the same as at Hartford station?

"A. Why, Providence would be a good comparison I should say. New London is another place somewhat similar, although the grade conditions are not identical. I think either of these stations are as hard to get out of as Hartford. At Hartford your track is nearer straight. There is a little curve. Your engine would be on a little curve going south. At Providence your train is on a curve and also upgrade going east. At New London you are altogether on a curve, but the track is almost level, that is, it slopes a little through London both ways.

"Q. You understand that when Engineer Spaulding, when testifying he spoke about the rear end of his train extending over the hump and down grade. You have operated passenger trains at Providence where you have the same condition?

1753 "A. Similar condition.

"Q. Now, what is your experience with reference to taking slack with power reverse under those conditions?

"A. I can control a train much better with power reverse than I can with a hand lever, because you can bring it back as easily as you like and as far as you like, where with the hand lever sometimes they work so hard when you get them started you will go further than you want them to. Sometimes they will work very good, but as a comparison the power reverse lever is much better to control a train with than a hand lever. A power lever is much better than a hand lever.

"Q. What about the speed with which you can reverse the power gear in taking slack?

"A. You can take it as gently as you like, but they are restricted as to the speed with which you can throw the lever from one corner to the other, that is, there is a port through which the air flows that is restricted so that you can't bring them back too fast and cause unnecessary slack action, which would be considered rough handling. Many times all you need is just the slack on the engine and head car, so you bring it back far enough behind the center to get that much slack and check it. You can do the same thing with the manual bar sometimes, not always (T. 6224–6234)."

I know Engineer James F. Jones and run the same class of engines that he uses. He is in regular service where I am in spare service doing all classes of work. I cover the same job as his at times.

"Q. Now, Mr. Jones testified that on through freight runs from Boston to New Haven and return with 150 cars going east, and I would like to ask you if you have had that experience in freight service?

"A. I have run those freight trains; yes.

"Q. And have you had trains of about the same size?

"A. Yes.

"Q. He stated that if the engine did not creep and was in good shape he could make Boston without taking coal, but when the engine was creeping he would not dare take a chance and would have to take coal at Providence. What is your experience about taking coal at Providence on those runs?

"A. Well, I would get coal at Midway, anyway, between Boston and New Haven to take coal at Midway as a matter of general practice.

"Q. Where is Midway?

1754 "A. It is between Providence and New Haven. It is 56 miles from New Haven and 101 or 2 from Midway to Boston. That is the spread I speak of for this 101 or 102 from Midwway to Boston. Now, it is possible that he has to take coal on that particular type of service for that reason, but it doesn't hardly seem possible to me because there are so many other things that enter into it, train delays, work to be done, and so forth.

"Q. What do you mean 'an so forth'?

"A. Generally wind conditions and track conditions and weather conditions. It doesn't seem possible to me that there could be difference enough in the amount of coal used due to reverse gear creeping to cause him to take coal at Providence.

"Q. On what experience do you base that conclusion?

"A. On my experience in that service (T. 6234–6236).

"Q. To what extent have you had experience with engines creeping in that kind of service?

"A. At times they will creep, but not bad enough to cause such conditions as he speaks of; at least I never saw them."

In passenger service they creep at times, but not enough to cause any great amount of difference in the amount of fuel used. They

go both ways. If an engine is creeping she may go down or she may come back from the point where you have her set. Sometimes you leave them run and see if they won't adjust themselves, and sometimes you correct the condition by moving the lever up or down.

My experience is that it is rather a rare occurrence to have them creep. It is just an estimate, but perhaps one trip out of 20 or 25 you will experience some degree of creeping. I have had very little trouble, especially in late years. Years ago, during and after the War, during our labor troubles, we had a lot of trouble in that way, but for the past five or six years there has been very little of it. If there is any such condition existing, it is reported reverse-gear creeping and it is usually corrected as soon as they get the report. The full fuel department is active and follows up those things very closely.

1755 "Q. Engineer Jones testified to some difficulties with the reverse gear on engines 3507, 3309, and 3500. Have you had any of those engines or had any difficulty in reversing them?

"A. I have had the 3507 quite a bit and I think the 3500. I have had the 3509 for a number of years."

I have had no difficulty in reversing the engine on those engines and have had no occasion when I had any breakage in the reverse mechanism that would cause a delay. I make speed up to seventy miles an hour, which is supposed to be our maximum and very frequently run pretty close to that. Many of our schedules are such that we have to make that speed. I cannot recall having any delays or lost time due to improper action of the power reverse on those runs. Occasionally during the holiday season, or when we have heavy travel, or occasionally due to break-downs, the company will work manually operated engines in that service.

"Q. Basing your answer upon your observations of the performance of the engine, and included in that I mean the sound of the cut-off and other factors that you may have in mind, can you say whether you work a closer cut-off with the power reverse engines or manual reverse engines?"

(Over objection of Mr. Morehouse witness answered.)

"A. We can maintain a closer, more accurate cut-off with the power reverse engines because your cut-off can be changed to any point at any time regardless of speed, grade conditions, or anything of that kind. You don't very often unhook hand reverse levers when you are going at any rate of speed."

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. Do you mean to leave the inference, Mr. Acker, that the power reverse gear going at high speed you can change the cut-off?

"A. You can change the cut-off; but as a matter of practice I wouldn't say that you do."

"By Mr. MOREHOUSE:

"Q. I will assume you meant when you said high speed 50 miles an hour or better, and would your answer be the same?

1756 "A. You would not have much occasion to change the cut-off going 50 miles an hour or better, but for instance between Canton Junction and Sharon going west you run quite a heavy grade, and frequently you want to crop them a notch or two notches, depending upon what kind of train you have going at what might be considered high speed, 30, 35, or 40 miles an hour. We do frequently have to give them a notch or two there. With the hand operated levers you hesitate some little time before you drop them. I have observed this from the men I fired for, but I never fired for Jones or Spaulding.

"Q. When you spoke of maintaining a more accurate cut-off, that was what you had reference to, that the speed you mentioned you in your practice at least would adjust the cut-off more frequently than if you had a hand bar?

"A. Yes."

In regard to fuel consumption I merely undertake to give my idea based on my own experience. Those things differ a good deal between different engineers, and I have no exact knowledge of the experience of Engineer Jones and Engineer Spalding. The fuel department follows up the gears pretty closely in order to check fuel consumption.

"Q. As a general proposition you haven't any difficulty with the hand reverse levers?

"A. As a general proposition, no. We get engines during the holiday season that have been in storage for some time, and there is more or less rust and corrosion, and they don't handle as freely as they do when they are in service right along, and occasionally with those engines we have some difficulty in throwing a lever from one corner to the other (T. 6234–6244)."

In regard to the matter of taking up slack, there is quite a lot of difference between the two types of gears, but I haven't had any difficulty in getting my train started by the power reverse gear, and

1757 I think the power reverse gear is a whole lot easier and quicker to handle. You can not hurry the power reverse beyond a certain designated speed, but I think as a comparison between the two you can get the power over fully as quick as you can the hand, as an average thing.

REDIRECT EXAMINATION

"By Mr. MCLAUGHLIN:

"Q. I ask the witness whether he could hurry the manual bar when he has steam trapped in the cylinders?

"A. You cannot.

"Q. When you are taking slack at a station do you usually take a pull at her before you attempt to take slack to see whether she will roll?

"A. You start with your lever in the forward motion and it all depends on the condition, whether you have to open the cocks and let out steam.

"Q. If you don't open the cylinder cocks, what happens?

"A. There are times when you can't get it over easily and sometimes you can't get it over at all, but you have to open the cylinder cocks in order to start the lever.

"Q. Are there any places where you keep away from the practice of opening cylinder cocks?

"A. There are, especially in local or suburban service. There are many places where you wouldn't want to open them, such as a crossing or platform, or where people are going by or various other conditions. In our through service mostly where we stop we open them, where there is consideration for those other things."

J. M. WYATT

DIRECT EXAMINATION

Witness Wyatt stated that he was a resident of Logansport, Ind.; that he first entered the employ of the Pennsylvania Railroad in 1914 as a machinist helper. He was promoted to hostler in 1917 and was in hostling service on February 26, 1923.

On February 26, 1923, I had orders to take engine 7760 out of the roundhouse to yard service. I brought this engine out of the roundhouse on the turntable, turned it around and opened
1758 the throttle and throwed it out intending to stop at the water plug to get water, when I wanted to stop the throttle wouldn't shut off and I could not shut the steam off. The arm had broken off and it would not hold the throttle in.

I set the brake and attempted to reverse it. It was equipped with a Johnson bar reverse lever and I couldn't reverse the engine. You could not get it on center and the air was not strong enough to hold it for the amount of steam it was getting. If I had been able to reverse it or could have gotten it on center I could have controlled it, but I failed to control the engine and it kept on moving and I could not stop at any time. I realized I was not going to be able to stop it and I jumped off at the yard office and ran to the door and told the man to notify them that the locomotive was getting away from me. Then I ran back to get on the engine. There was a switch tender, a one-armed man, that got on the engine just before the brakes gave way. He tried to get hold of the reverse lever but could not do anything with it. I made another attempt to reverse it. I left her down in the corner and braced my foot against the boiler head to bring it back and could not. That is about the time the brakes let go and I didn't have any more resistance so I got off. I know the engine was going at the rate of about 35 miles an hour when I got off. I saw this engine the next day and it was pretty badly broken up. I felt that the main reason that I could not re-

verse that engine was that there was too much steam, and the reverse lever worked hard without any steam, and with a lot of steam it worked considerably harder (T. 6244–6254).

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. You had to throw the hand reverse lever in the house in order to back out didn't you?

"A. Yes; I put her in back motion.

"Q. How did you find the throttle working?

1759 "A. It worked pretty stiff.

"Q. Did you throw the lever again at the time you went to the turntable?

"A. Yes; put her in forward motion to leave the turntable. I was going to stop at the water plug about 150 feet from the turntable. The throttle would not close when I got ready to stop at the water plug. When I attempted to stop I put on the brakes and commenced trying to reverse. The reverse lever worked hard and it was getting too much steam. The cylinder cocks were open all this time.

"Q. In the statement you made shortly after the accident, you made a statement that the reason you did not succeed in reversing it was because you could not lift the latch, didn't you?

"A. No; I could not release the pressure any more on the reverse lever. It was pulling too hard is all I can tell. After the brakes quit holding. It was pulling too hard. The brake system was the old style Westinghouse brake equipment. That was the only engine we had at that time equipped that way. I had no more brake resistance after the brakes quit holding.

"Q. Just what is your idea as to the connection between the brakes and the latch on this reverse lever?

"A. I always felt that if I had independent air brakes I would have been able to hold the engine down and to have done something with it.

"Q. The operation of the brakes has no connection with the movement of this latch on the reverse lever, has it?

"A. No; only gives you a little more time.

"Q. Why was it these brakes didn't hold; did you not have air enough?

"A. I don't know. The air seemed to be pumped up, but it did not stop the engine at any time.

"Q. The air stopped the engine all right when you first put it on the table?

"A. When I was able to shut the steam off the brakes held the engine.

1760 "Ex. ROGERS. The brakes were not sufficient to hold the engine against the throttle pressure?

"A. I could not shut the throttle off."

"By Mr. MOREHOUSE:

"Q. Mr. Wyatt, assuming in this case that for some reason or other with power reverse gear on that engine that your power reverse gear was stuck or would not operate so that you could not reverse the engine, then you would have still had the same result, would you not?

"A. If you could not move your reverse lever and the brakes would not work the result would be the same.

"Q. Mr. Wyatt, you were relieved of your work as hostler for allowing this engine with a broken throttle fulcrum to get away from you on this occasion, were you not?

"A. Yes, sir (T. 6267–6272)."

M. M. MOORE

DIRECT EXAMINATION

Witness Moore stated that his residence was Paris, Tenn.; that he first entered the employ of the L. & N. as a fireman in 1907, and the next time in 1911, and that he was promoted to engineer in 1919. He stated that he was now firing in L. & N. passenger service.

I wish to state in my own way an unusual occurrence which happened on October 31, 1919. I was hostling and had an engine in the roundhouse that they had been working on.

"Mr. MOREHOUSE. I object to any statements of accidents or evidence on accidents at this time.

"Ex. ROGERS. Objection overruled."

On that particular day they were working on a locomotive. The hostler and machinist came around and asked me to move the engine ahead a little bit. I got up there, started the air pumps to run. There was full pressure of air and I started her ahead. I had the r verse lever down in forward motion. It was a manual reverse lever. When I got ready to stop I put the brake on; I did not have any brakes, as they had been cut out; so I went to reverse and I could not move the reverse. Then I went through the round-
1761 house wall. The reason I could not reverse the engine was because a piece hung in the quadrant. If I had an engine equipped with power reverse on that occasion I could have reversed it. I didn't jump off, but the engine went about half her length through the wall, when she stopped herself. Another man came up in the cab and helped me try to reverse it, but the two of us did not succeed. After that I got the tool pack and knocked the latch out of the quadrant, then I was able to reverse her.

"Ex. ROGERS. Are defendants willing to concede that cases as these two witnesses have testified to can happen and have happened with the manual reverse lever?

"Mr. MOREHOUSE. I don't care to make any concessions for the record, I wish to point out that in this case this man stated that

he had air, and the class of cases we showed was where there was no air or at least insufficient air to operate the power gear."

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. It is customary when engines are undergoing repairs to shut off the air?

"A. Yes.

"Q. Both to the brakes and the power-reversing gear and any other air appliances?

"A. All of them.

"Q. So that in this case, when you moved your engine forward, if it had been equipped with power reverse gear you would not have had any air to move your reverse mechanism backwards?

"A. Yes; I would have turned the air on before I started.

"Q. Why didn't you examine this hand lever before you started?

"A. I did but they were cut out on me underneath the running board, that is, the air brakes were cut out.

"Q. Why didn't you turn your air brakes on before you moved forward then?

"A. I turned the pumps on.

"Q. You say if you had a power gear you would have turned the air connection on to the power reverse gear before you started?

1762 "A. I would not have had to because if you had the power reverse the air would be going into that power reverse.

"Ex. ROGERS. Do they shut off the air connections or just the pumps?

"A. Shut off the pumps.

"Ex. ROGERS. And leave the connections as they were?

"A. Yes."

"By Mr. MOREHOUSE:

"Q. Now, which is it Mr. Moore, you have stated both ways, which way do you want us to understand it?

"A. I want you to understand they shut the air pumps off, and they were working on these brakes and when they were working on the brakes they cut them out underneath there.

"Q. You got up there and gave her some steam without trying the lever first to see whether you had any brakes or not?

"A. We are not supposed to look at them to see if they cut them out and if they do cut them out they are supposed to tell us about it.

"Q. Is it your idea that when an engine is undergoing repairs you can get up and start off on the assumption that everything is all right?

"A. That is our understanding.

"Q. How far did the air pump up?

"A. To 70 or 90.

"Q. How long was it?

"A. Eight or 10 minutes.

"Q. In all that time you made no attempt to find out whether air was put into the brakes or not, did you?

"A. No.

"Q. How far were you from the round house wall when you started forward?

"A. About 18 or 20 feet.

"Q. Was that long enough distance so that if you had been able to operate this hand lever you could have stopped and prevented going into the wall?

1763 "A. Certainly could.

"Q. Have you used hand levers in cases of that kind?

"A. I have; yes, sir.

"Q. And have been able to stop all right in that short distance?

"A. Yes, sir.

"Q. Now, just assuming Mr. Moore that if you had a power reverse gear on that engine, and the lever on the power reverse had stuck in the forward corner like this hand lever was stuck so that you could not move it back, you would have had the same result?

"Mr. McLaughlin. I don't recall any such hypothesis in the record; I object.

"Ex. Rogers. Go ahead and answer.

"A. If I had had a power reverse and if it stuck I would have had nothing to stop with.

"By Mr. Morehouse:

"Q. If the air to the air reverse had been cut off and you had failed to turn it on before opening your throttle, then you would have had the same result also, wouldn't you?

"A. Certainly.

"Q. I show you this statement and the signature at the bottom 'M. M. Moore', and ask you if that is a statement you made out on October 31, 1919, and in filling out the cause of the accident you wrote heer 'had no brakes and engine cylinder full of water and could not get her stopped, I could not reverse engine'?

"A. Yes; I certainly did, that is what I stated at that time."

REDIRECT EXAMINATION

"By Mr. McLaughlin:

"Q. I want to ask the witness what he meant there, what the condition was about the engine cylinder being full of water?

"A. It was a condensation in the steam pipe and runs down to the pump.

"Q. Had you ever had a power reverse lever stick in the front corner or the back corner?

"A. No.

1764 "Q. Mr. Moore, I want to ask you if you were given any discipline as the result of the accident?
"A. Ten days (T. 6255–6265)."

D. L. LINDSAY

DIRECT EXAMINATION

Mr. Lindsay stated that he was a resident of Louisville, Ky., that he was first hired in 1902 by the Louisville & Nashville and was promoted to engineer in 1908. His principal service was in freight, passenger, and yard work, mostly in freight. During the last 4 years he has operated engines equipped with power reverse gears of the Alco type. These locomotives are the Mikado type and weigh around 250,000 pounds on drivers. He ran for 10 years between Louisville and Nashville. At the present time he is assigned to a run between Louisville and Corbin.

I wish to recall an incident, testified to by witness McPhail at page 3755 of this record, in which he described an occurrence with a power reverse gear, coming north between Bowling Green and Louisville. There is a distance for a mile or two down here that we call whiskey hollow that the speed of the train gets up around 45 miles an hour. Suddenly the engine became lame, I eased off on the throttle and dropped her down a notch, stopped, and then we went on without stopping. The lever was forward about as near center as I could get her without trying to be exactly on center. I don't know as I observed anything wrong with the engine. It acted all right, only the noise out front, the exhaust. It was a sort of a chuck-a-luck. Out of the 4 exhausts one of them is louder than the other. I don't know as I observed anything wrong with the engine. It acted all right only the noise out front or out at the exhaust. Nothing happened to the engine. We were about 90 miles from the terminal and I took the engine and train in. There was no more trouble with the locomotive. I didn't hear this particular noise any more.

1765 Over the objection of Mr. Morehouse the witness testified that when they stopped at Cave Spring to take water and oil around, Mr. McPhail came around the engine with him and said that was the first time he heard anything like that on an engine, an engine act that way, and he supposed it was lost motion in the valve gear that caused this particular noise at that time. I run into the territory in which Jesse Trailer is my traveling engineer, having jurisdiction over my run between Louisville and Corbin. I have not had any creeping with those engines and this answer includes the four years I spoke of in both of these divisions. I am local chairman at Louisville.

By Mr. McLaughlin:

"Q. I wanted to ask you Mr. Lindsay whether you ever had an engine with manual reverse act the way this one did on the occasion that Mr. McPhail was with you.

"A. Yes; I was on a run between Louisville and Nashville going toward Nashville over a fast piece of track with engine 1009, equipped with a manually operated reverse gear. This engine suddenly became lame with the lever hooked back about center, and I stopped to see what was wrong and examined the engine and found nothing wrong. We proceeded on to Nashville with the entire train and had no further trouble with the engine that day. As to my explanation of what the difficulty was, I will say that I couldn't find anything wrong, but I have a good idea what it was. I don't think I worked the engine quite that high after that occasion. If I did, it never happened any more. As to what caused the lameness in each of these questions, I would say from my experience as an engineer that something was wrong with the valves, either lost motion or something wrong with the mechanical end of it. I could not find out. I don't know."

CROSS-EXAMINATION

By Mr. Morehouse:

"Q. In this first instance, Mr. Lindsay, did you have the power reverse gear hooked up in your ordinary running notch?

"A. We do not have an ordinary running notch. For an up and down grade we will always adjust them.

1766 "Q. When you say about the center, how close to center do you mean?

"A. When the lever is almost straight up (T. 6273–6283)."

J. E. Wortsmith

DIRECT EXAMINATION

J. E. Wortsmith testified that he was a resident of Detroit, Mich., and first entered the employ of the Wabash as a fireman in 1885 and was promoted in 1892. He stated that at the present time he was in transfer service between 17th Street and Oakwood, Detroit, and is using an 8-wheel switch engine with a weight of 216,000 pounds on the drivers, what is known as 0–8–0 arrangement. He stated that he had been operating engines in that general territory for 39 years and that the engines he is now handling are equipped with Ragonnet power reverse gears.

"Q. Do you know Mr. H. L. Cosper?

"A. Yes, sir.

"Q. He testified in this hearing in June. He testified to the extent that on an engine operated and equipped with manual reverse, that you operated on such an engine, when your seniority entitled you to run on an engine on the comparable service that was equipped with power reverse. Were you handling an engine equipped with manual reverse in June of this year?

"A. No.

"Q. How was it equipped?

"A. With a power reverse.

"Q. Were you operating in June of this year an engine equipped with manual reverse?

"A. No.

"Q. You were running an engine equipped with power reverse?

"A. Yes.

"Ex. ROGERS. How long has it been since you had an engine equipped with hand reverse, I mean as a regular job?

"A. It is over a year. About 4 months ago I had such an engine for a day or so.

1767 "Q. Was there ever a time since you have been with the Wabash that you remained on an engine equipped with manual reverse when you could have gotten one equipped with power reverse?

"A. Other things being equal there has not been. There has been one exception. There was one job that a man that was on there that was not physically fit for any other kind of work, and I wouldn't bump him. I waived my rights in favor of this man on that particular job.

"Q. That is the only time you ever remained on an engine equipped with manual reverse in preference to one with power reverse?

"A. Well, the way we are assigned to a job, we have to take whatever engine they put on there, and, to make it clear, we have three starting points there, at 17th Street, Delray, and Oakwood, and I always stayed on the job that started at Delray. If I could, I always took that job.

"Q. Do you have any preference with reference to the manner in which an engine is reversed, or with what power it is reversed?

"A. I would take a power reverse in preference to a manual."

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. What did you mean, Mr. Wortsmith, when you said other things being equal?

"A. The starting time and the starting point. I would not bid for an afternoon job where I finished work as late as 9:00 o'clock in the evening for the sake of having a power reverse. I was 67 my last birthday and weigh about 140 pounds."

MURRAY L. MCCULLOUGH

DIRECT EXAMINATION

Witness McCullough stated he was a resident of Baton Rouge, La., that he started firing on the Y. & M. V. division of the Illinois Central, January 21, 1921, and was promoted October 4, 1925. He stated that he was now running part of the time and firing part of the time. I know Engineer W. K. Rust, and I have been
1768 running and firing in the territory where he works. I have fired an engine for him on that run off and on for the past eight or nine years on a temporary basis, and I have caught it anywhere from three days to two and three weeks at a time. The last regular assignment I had with Engineer Rust was some sixteen or seventeen months ago, and I fired for him at that time about two and one-half to three months. Prior to that I fired for him irregularly as I got these spells when I held this run. Since that time I have fired for him irregularly. During the time I was speaking of when I was firing for Engineer Rust, I fired practically every class of engine they have on that run. I fired engine 5063; that was the regular engine which I was assigned to that run. I did not observe Engineer Rust having any difficulty with creeping with engine 5063. The schedule was maintained at all times unless we had to wait with connecting passenger trains from Chicago. When Mr. Rust was running engine 5063 he obtained high speed at all times whenever we were on schedule, unless delayed by some other unknown cause, such as getting flagged by a local. We made fifty to sixty miles per hour with that engine while he was running her, and that is the usual high speed made by engines over that district.

We have power-reverse engines on 1000 and 1100 Pacific-type engines and on the 500, 1500, 1600, and 2000 class. We have power reverse on the 3500- and 200-class switch engines. Practically everything we use is power reverse.

Ex. ROGERS:

"Q. Have you ever experienced any increased fuel consumption due to creeping?

"A. No, sir (6283–6293)."

CROSS-EXAMINATION

"Q. Do you recall what engine you fired for Engineer Rust about a year and a half ago?

"A. The engine he had when I first went on the run was a manual reverse, engine 5062. He used the manual engine some three or four trips, perhaps a week after I went on the run. After that he had the 5063, which was supposed to be his regular engine."

1769 L. P. GOLSON

DIRECT EXAMINATION

Mr. Golson testified that he was a resident of Baton Rouge, La., that since October 15, 1920, he has been an engineer on the Y. & M. V. division of the Illinois Central, and that before that he fired on the Illinois Central. He said he had been operating power reverse locomotives for about 8 years and had operated the engines belonging to the same class as 5063, concerning which Engineer Rust testified.

"Ex. ROGERS. Have you had any creeping of the power reverse gear?

"A. Very little.

"Ex. ROGER. Now, when you did have that little creeping, did you notice whether it caused any increased fuel consumption or not?

"A. I did not notice."

By Mr. MCLAUGHLIN:

"Q. Now, Mr. Golson, Mr. Rust testified that engine 5063 did considerable creeping, and that he was unable to make high speed with that engine, also that he never had any difficulty in handling manual reverse. Have you heard Mr. Rust make any remarks on those subjects?

"A. Yes; on August 4th he was registering in the office and was talking to the general foreman. They took the 5063 away from him, and he had engine 5001, with a Johnson reverse bar on it. He was laying off on account of this 5001 being on his run. He made a statement to the general foreman, Gebhardt, about changing engines on him, that he was not physically able to handle the 5001 on his run, and that engine 5063 was a much better engine for that run because it had a smaller wheel base, power reverse, and more steam power. He stated that if they kept this 5001 on this run regular he would have to get down, that he was not physically able to stand it (T. 6293–6303)."

CROSS-EXAMINATION

"Q. Where were you at the time the conversation took
1770 place between Gebhardt and Rust?

"A. About 8 feet away.

"Q. What did they say in addition to what you have already stated while you were there?

"A. Rust said, 'It seems every time there is a change made in the engines that I am made the goat; that I get the worst of it.' In my opinion he was pleading for the 5063 back, which had been his regular engine.

"Q. And he stated while you were there, what you heard of it, was that he did not like this engine 5001?

"A. Yes. He said it was too hard for him to handle on that run doing local work.

"Q. Is that all he said about that engine; the only objection he raised to it; that is, that you heard?

"A. Yes, sir.

"Q. Were those the words that he used, as near as you can recall, that the engine was too hard to handle?

"A. As near as I can recall now.

"Q. I believe you said he stated that one of these engines had a smaller wheel than the other?

"A. He did.

"Q. Which one did he state had the smaller wheel?

"A. 5063.

"Q. If I understand you, he didn't say what there was that was wrong with his physical condition?

"A. No, sir.

"Q. Is that correct?

"A. Yes (R. 6305)."

I do not know what his physical condition is at the present time (R. 6306).

"Ex. Rogers. Did he say anything about his physical condition?

"A. He said, 'My physical condition is not able for me to stand it.'"

1771 EDWARD R. BOA

DIRECT EXAMINATION

Witness Boa stated that he lived at Buffalo. I have been subpœnaed to appear, but I have had no conversation with any one on complainant's side about what my testimony is going to be. The Traveling Engineers Association is an organization composed of engineers who have been promoted to an official position with the railroad known as traveling engineer or road foreman. The purpose of this association is to derive all the benefits from each other's knowledge of practical operations and to discuss matters for the benefit of railroad men in general. This association holds conventions every year. I was chairman of a committee which read a paper at the 1929 convention of this association in Chicago upon the subject of the extent to which modern appliances have contributed to the economical operation of locomotives. The other members of my committee were W. L. Robinson, I think from the B. & O.; Roy Hammond, from the New York, New Haven & Hartford; M. A. Daley, from the Northern Pacific; D. I. Burger from the Wabash, as I remember it; and W. F. Fifield from the Southern Pacific. I am from the New York Central.

With respect to this report I should say that practically all of it represents or conforms to my views because if it had not, I would have objected to it. I would say the paper represented my views

personally and individually. I am now road foreman of engines or traveling engineer with the New York Central and have held that position since 1917. Before that I ran an engine in freight service from 1895 to 1913, and in passenger service from 1913 to 1917. As to how long I have run with the hand lever, I will say that we had a few air-reverse gears, if any, in passenger service before 1917. Most of the passenger engines I handled I would say was (manual) reverse lever. I know we did have some air reverse, but whether it was since I was road foreman or not, I won't say positively.

"By Mr. McLAUGHLIN:

1772 "Q. Mr. Boa, I call your attention to this paragraph.

"Exam. ROGERS. Let him read it first.

"A. This paragraph right here, 'Power-reverse gear'?

"Q. Yes.

"A. I have not got nothing to take back on that.

'Q. I am calling your attention to a paragraph in this report under the heading, 'Appliances which may be termed mechanical improvements'?

"A. Yes.

"Q. The paragraph started with the words 'Power-reverse gear'?

"A. Yes.

"Q. Will you read into the record what this paragraph is?

"A. You want me to read that all?

"Q. Yes.

"A. All right. 'Power-reverse gear assists the engineer to use each pound of steam to the best advantage by holding the cut-off in the desired position and making it free for the engineer to change the cut-off regardless of speed, which cannot be done easily—' I want to emphasize that word there 'easily'—'which cannot be done easily with the old reverse lever. This appliance has also added to the efficiency of the locomotive in switching service.'

"Exam. ROGERS. Did the committee have a meeting before this report was adopted?

"A. We wrote to the different ones and got recommendations, as you might term it, but we did not have a meeting on the subject.

"Exam. ROGERS. Did you have any evidence that the other members of the committee concurred in this report?

"A. Oh, yes.

"Exam. ROGERS. Were there any objections by any member of the committee to that paragraph?

"A. No, sir.

1773 "By Mr. McLAUGHLIN:

"Q. And the paragraph you have read here is what you read at the convention?

"A. Yes, sir.

"CROSS-EXAMINATION

"Exam. ROGERS. What I understood you to say a while ago, your views had not changed?

"A. I said I did not have anything to take back.

"By Mr. MOREHOUSE:

"Q. You have had some experience since that was written that gave you a little different slant on this power reverse, haven't you?

"A. Yes.

"By Mr. MOREHOUSE:

"Q. State what experience you had with engine no. 5307 recently?

"A. It was night before last, train X–4 with 14 cars. The engineer that came into Buffalo off the run west on that engine made the remark to me, 'She is a hell of a good engine, but the reverse gear creeps bad.' That is just the exact remark. After leaving Buffalo I took special observations of the gauge, as this locomotive is equipped with what is called a valve pilot, which indicates the cut-off on the valve here, between the speeds of, as near as I can recall, 30 miles an hour up to about 50 or 55. The reverse gear would creep with the hand on the gauge varying 5 points, that gauge is a

vary these 5 points, or 5 miles on the gauge. As the speed got up to around 60 miles an hour, it stopped vibrating, and it registered very accurately up to 70.

"By Mr. MOREHOUSE:

"Q. Then do I understand that the variation on this gauge that you mention had some connection with the creeping of the power reverse gear?

"A. It indicated just how much it was creeping.

"Ex. ROGERS. Where was the engine working at that time; 1774 where did you have the lever?

"A. We hadn't got the gauges stenciled off exactly, but you have got the black hand, which registered the cut-off, at about 50, and from there you will have about a 33 percent cut-off, and then if it is down to 60, why it is about probably 38 percent. This engine was equipped with the latest type precision gear.

"Ex. ROGERS. How far did you ride this engine, and how many times during that period did she act this way?

"A. About 85 miles and the one time that it was noticeable was between Buffalo and Batavia. That is upgrade, and you have got to work the engine pretty stiff; from Batavia to Rochester you can use a very light throttle, and it does not creep. The heavier throttle you use the more it is liable to creep; in other words, the more steam you are using in your cylinders and valves the more liable they are to creep. It is 33 miles from Buffalo to Batavia, and we made it in 38 minutes. After this incoming engineer made that remark, it was

right on my mind to watch the valve pilot as quick as we started out of Buffalo, and he went right after he good and heavy, and as the speed went up to 30 and continued on up to 60, we were going 70 before we got to Batavia.

"Ex. ROGERS. How many miles were you out of Buffalo before you got to the point where it did not creep?

"A. We were behind Corfu, about 20 miles from Buffalo. We were over the hill; that is, the hardest part of the hill west of Corfu.

"Ex. ROGERS. You say, when you are going 55 she creeps, but when she gets up to a high speed she did not?

"A. That is right; they don't use as heavy a throttle when they get up to 20. We regulate the speed with the throttle, and easing off on the throttle reduced the pressure of your valves. In my opinion when you ease off on the throttle the valves stay set.

"Q. Can you explain for the record so that we will know what that valve pilot or gauge is?

1775 "A. It is a duplex, one hand is red and the other one is black, the red hand indicates your speed and the black hand your cut-off. It is connected up to the tumbling shaft on the valve gear and every time you put the engine back on air reverse, every time you give the wheel a turn back it keeps on raising the black hand on the gauge.

"Ex. ROGERS. Is there ribbon connected with those?

"A. Tape. By that tape you can tell where the cut-off is working.

"By Mr. MOREHOUSE:

"Q. Did you notice whether or not while this creeping was going on, the hand wheel on this precision gear was moving or revolving?

"A. No, sir; it was latched every second.

"By Mr. MOREHOUSE:

"Q. Could you tell from the indicator of this valve pilot gauge to what extent the valve motion, the adjustment of the valve motion or cut-off, was varying as this creeping was occurring?

"A. You got to figure it, if you want to bring the hand up 5 miles on the gauge you make very near a quarter turn of the wheel. That may not be absolutely correct but it is in that neighborhood.

"Q. That again would be equivalent to five miles difference in the speed, if the motion were where it was supposed to be?

"A. Yes; it would be; yes.

"Exam. ROGERS. Do you mean you slowed down five miles due to this creeping?

"A. According to instructions you should run your hands certain points on the gauge at certain speeds. If that is fluctuating five points, why you are not getting the full benefit of your valve travel, if she is fluctuating in that manner.

"Exam. ROGERS. But that does not mean that this creeping slowed you down five miles an hour?

"A. No, no; it is not noticeable on your speed at all.

"Ex. ROGERS. Let me see if I can understand it. For different speeds, your cut-off is supposed to be a particular place and if
1776 the speed you were going was a certain speed and you were off with your cut-off by this equivalent of 5 points, is that it?

"A. Yes, we will say you hook her up to 50, if she remains at 50 all right and good and every time she would creep she would creep back to 45, she would keep creeping back to 45, you are losing that much efficiency in the locomotive, whatever effect that will have.

"By Mr. MOREHOUSE:

"Q. Has anything occurred, or have you had any experience or observations since this report was read in 1929, Mr. Boa, which has given you any different slant on the effectiveness of power reverse in holding the cut-off at the desired position?

"A. If the power reverse would stay just exactly where you want it, it would be 100 percent, but it don't stay where you want it. I am not saying anything against what I said in that paper. That is a nice thing for engineers to handle, makes it very much easier and more efficient but there is this to it, that the power reverse gear does not stay just where I think it should (T. 6313–6323).

"Ex. ROGERS. How does the operation of an engine with a gear like that that won't stay just where you put it compare with the old hand gear?

"A. You take the old hand gear, and a man had to use more muscle and a lot of strength to handle it. You could not handle the old lever in any comparison like you can the air reverse.

"Exam. ROGERS. You mean even when it is not working just right?

"A. That don't effect you one iota. If you did not have a gauge to tell you you wouldn't know it half of the time. A man can handle the reverse gear with one finger when it is operating right.

"Exam. ROGERS. What is your experience of the portion of the time when it is not operating right; is that very much?

"A. I have had cases where I have reported them and had them overhauled where they were too bad. A creeping of five points on the gauge was not what I term bad.

"Ex. ROGERS. What percentage of the engines you run or ride do you have occasion to criticise the performance of the power reverse?

1777 "A. Somewhere along about 1 out of 30. I am not saying all the rest are absolutely accurate on their cut-off. The ones reported have a variation that would amount to more than 5 miles an hour.

"Q. Can you give us any idea of how many cases of ordinary creeping that you run into?

"A. They do not exceed the five miles on the gauge. There are not very many of them that are right on the dot.

"Q. There are not very many that do not creep to some extent?

"A. Absolutely. They all do. Now, I do not want to go positive on that, but I don't believe I ever seen one that didn't creep a little some time when you are batting them good and wicked. They would not go five points, but only three, but they will show it (R. 6326).

"Q. You haven't observed any difficulty in maintaining the desired point of cut-off with a Johnson bar or hand lever, have you; if you set it, it doesn't creep, does it?

"A. It doesn't creep if it doesn't jump. I had one jump out, it caught my leg, and that was creeping too damn much. I have had them jump out more than once.

"Q. Did it hurt very much?

"A. Yes, but it didn't break my leg. I did not lose any time. I had my leg against the boiler and my foot slipped off the pipe. That was way back in 1904 or 1905. They did not have any foot brace outside the boiler for me to put my foot on at that time. It was up against a pipe. If I remember right, it was the flow pipe to the gauge cocks we used to put our foot on. I didn't put my foot lower down because I would not have as good a purchase. I had to get my let right straight."

E. W. Erisman

DIRECT EXAMINATION

Witness Erisman stated that he was a resident of Decatur, Ill., that he first entered the employ of the Wabash as a fireman in 1903 and was promoted in 1912. He stated that he had been in freight service for about 10 years with a run between Decatur and
1778 Peru, Ind., 172 miles, operated the 0–1 class and the 4–8–4 type locomotives. These engines are equipped with the Alco power reverse gears. I have been making about eight and one-half or nine (round) trips per month between those points, or about 2,900 miles per month. I have been in service regularly making every trip for the year ending September 1931, and running the 0–1 engines. During that period I have had possibly one or two occasions where the power reverse gear would creep, as I recall it. I have no record of it.

"Ex. Rogers. He wants to know whether you did notice any difference in the coal consumption between engines that were creeping and those that were not?

"A. We take coal twice on this division, and by simply looking at the coal pile in the tender, it would not be noticeable.

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. You yourself didn't take any particular notice or endeavor to determine whether there had been any more coal used on those occasions, did you?

"A. No; but my opinion is that with the gear creeping you will burn more coal; however, the engineer has no actual record of what that may be.

"Q. You make a report if there is creeping enough so that you notice it in the exhaust; it might be creeping but not enough to effect the exhaust and you would not know about that?

"A. Yes; if you notice it in the exhaust. The gear is hung in the running board and we could not see the position from the cross head in the cab. Our engines on that division are run between Decatur and Montpelier, and they change engine crews at Peru. If there are any unusual conditions that commence during the trip, we call the other engineer's attention to it, so that he can make the report. Practically all of the locomotives in the service go through, and written reports would only be made at the end of the line (T. 6323–6333). I cannot recall how many times during the past year I have had occasion to report this creeping to the engineer at Peru who took the engine from me. I could not say if it
1779 would be as many as a half dozen times. I can't recall more than one or two times when I reported on work reports at the other end. I have made such reports as 'pack air reversing piston', which means I had some creeping on that trip. At other times I have reported it as 'reverse gear floats.' Upon a question from the examiner, counsel indicated Mr. Erisman's work reports for 0–1 engines showed four reports on creeping which were read to the witness as follows:

"By Mr. MOREHOUSE:

"Q. The first report on creeping is January 6, 1931, engine no. 2906, 'pack air reversing piston'; February 1, 1931, engine no. 2900, 'reverse gear floats bad'; April, day of month not shown, 1931, 'reverse gear floats.' Those were all reported at what point?

"A. Decatur.

"Q. You had some trouble here recently on an 0–1 engine with the air supply pipe of the reversing gear breaking?

"Over objection of Mr. McLaughlin, witness answered:

"A. Yes; at Bement, Ill."

JOHN A. HARNISH

DIRECT EXAMINATION

Witness Harnish stated that he was a resident of Altoona, Pa., and was employed as a locomotive engineer by the Pennsylvania Railroad and was running an engine up until the 17th day of

January 1931. He stated that he operated the 2–4–2, known as the L–1–S type, equipped with the manual screw reverse, and on January 17, 1931, he was operating engine no. 64.

"Q. Will you describe the location of the manual screw gear, so far as any part of the inside of the cab is, and your usual position in operating it.?

"A. There is a standard way of applying the manual screw type of reverse. The reverse gear is applied on the right side of the boiler head. The boiler head slopes and the wheel would be between the clearance of the boiler head and the cab window. As you sit on the seat box the wheel is right in front of you, ordinarily about 12 inches away. They do vary slightly, but I could not tell you exactly. There are times that it is so close that it will catch your watch chain (T. 6333–6343).

1779a G. H. ZOUCK

DIRECT EXAMINATION

Witness Zouck stated that he lived at Orange, N. J., and was chief division engineer for the Franklin Railway Supply Company. This company manufactures the Ragonnet and the Franklin type, which is an improvement of the Ragonnet. It also manufactures another type known as the Precision, which is made in two general types, one of which is air controlled gear entirely and the other of which can be restrained or manually locked. I am familiar with all of the various types of power reverse gears made by my company and have knowledge of their development. The first type sold was the Ragonnet A. It was not made in our shop. We marketed type B which we made in our shops early in 1917. The original Ragonnet A consisted of a piston having a metallic packing. The ratio of movement between the valve and the piston was about 10½ to 1. The first model had a 24 inch piston travel which was later reduced to 18 inches. The valve travel on the A was longer than on the B; both were provided with cross heads. Type A had a longer valve, and the valve stem came out the forward end of the casting and had packing there. There was a great deal more mechanism to the type A than to the type B. In type B we reduced the number of working parts. In 1915 or 1916 we took out the metallic packing and tried a square softer packing in both type A and B. In type B we reduced the ratio of movement between the piston and valve travel from first stage 10½ to 1, and second, 392 to 1, while the first B was 362 to 1. That reduction in ratio was to give the gear more sensitiveness and take out floating and bring the valves back to normal in case a load was placed on the piston. By making it more sensitive I mean that it could adjust itself more quickly to the load placed on it, with less movement. If the ratio from valve to piston movement was 10 to 1, the piston

would have to move ten inches to one inch movement of the valve. If it was 5 to 1, the piston would only move five inches to one inch movement of the valve. When I said we did that to make it more sensitive I meant that the valve would respond more readily to the movement of the piston. That is, if there was any movement in the piston, then the valve would more readily respond to that and adjust pressure on either side of the gear piston to counterbalance the force that it was throwing upon the piston by the valve motion and bring it back to its original position.

In 1922 we brought out the Ragonnet type E gear, which had a 19 inch piston stroke, which is the standard today, and we 1779b also applied to that gear a negative admission lap, the object of which was to always be assured that there was reservoir pressure on one or the other side of the piston or gear proper. Without that condition, when you have a positive lap, it is quite possible for the friction of the gear, which is the initial holding power, to hold the valve motion under normal conditions for some little time, and gradually the air pressure would drop and then the gear itself will shuttle back and forth until it is built up on either side, but if you have the negative lap one end, usually the forward end, is always in direct communication with the reservoir, so that you do not have the condition I have just described.

In the type E gear we removed the cross head entirely and substituted a generous sized hollow piston rod, with a generous bearing at the front head, which simplified the construction materially. The hollow rod also permitted an advance between the cup packing. This gear was supplied with cup packing instead of the old square packing and permitted easy examination for leaks past the cup packings, which was desirable. It also provided a means of oiling the cylinder by introducing oil through this cup and forcing it to the cylinder walls. We applied this cup in 1921 to practically all the gears, and it is standard today in the industry. The elimination of the cross head and guide reduced the weight considerably.

My duties when I first went with the company were to be in charge of testing and development work. I still do that work along with other duties. At present we are manufacturing the Ragonnet types B and E, although we are placing our effort on the E. We manufacture A type for particular order only.

The B that is manufactured now differs from the B in 1917 in that cup packing has been substituted for the piston packing. This change was made in 1921. The valve now has a negative inlet lap instead of the former positive lap and other improvements such as the use of hardened pins and bushings to increase life.

The Precision gear differs from the Alco gear in that the valve is connected to the piston by means of a screw instead of a combination lever which results in a 1 to 1 ratio movement between valve and piston. That necessitates a hand wheel to operate the gear in-

stead of a lever. It also results in quicker action and less floating than in other gears of this character. No provision is made for steam connection in the Precision gear; that is not necessary. In case of failure of air to reach the gear due to any cause you can operate the gear manually just as you would the old screw type reverse gear.

1779c As to my experience in the operation of the precision gear when the air pressure is off, I have seen quite a few engines so equipped with the air pumps shut off; this is with reference to the engines standing still, but the same condition would apply if the engines were in motion. I know that, because I have been upon engines which have been operated that way. I also speak from the standpoint of the design of the gear itself. With the precision, in the event of loss of air, any movement of the gear trunk will be limited to the permissible valve travel of the power reverse gear, which varies in different models from a half inch to an inch and a quarter. The maximum that the valve gear would move would be an inch and a quarter with the type D precision, ¾ of an inch with the F–1, and ½ inch with the F. That is the reach rod that goes from the tumbling shaft to the reverse gear. I don't know how far the other parts would move because it depends on design (T. 6343–6363).

CROSS-EXAMINATION

The difference between type A Ragonnet gear and type B insofar as the ratio of the piston movement to the valve movement is concerned is the difference between 362 to 1 and 392 to 1; also the valve on the type A had a positive inlet lap and the type B has a negative; the valve can be changed in the locomotive shop; the difference between the positive and negative is merely in the inlet ports. The valve is of such length that one end of the gear piston is always open to reservoir pressure. That is so even when the mechanism is at rest because the valve is shorter than the distance between the ports. The purpose of that is to more readily overcome this creeping due to leakage—if you term that creeping. It depends entirely what you mean by creeping.

"Q. Call it moving?

"A. It is a gear that acts as quickly as possible to correct any change in position due to extra force.

By Mr. MOREHOUSE:

"Q. Is there not a more or less constant change of position in the power reverse piston due to the force of the valve motion on the piston?

"A. In the case of any power reverse gear of this type there is a certain amount of friction in the parts such as cups and packing.

1779d It will vary from 100 to 600 pounds. If there is sufficient variation in pull on the valve motion to overcome that preliminary friction the piston will be pulled a certain distance

until the valves in the reverse gear can discharge sufficient air to counterbalance the new forces existing. That will depend a while lot on any movement or variations in the locomotive itself. We do make a reverse gear that does not have this feature, and can maintain cut-off absolutely constant, irrespective of pull.

"Exam. ROGERS. Can you tell us what would be the maximum movement of the valve gear under that condition?

"A. In the valve gear it depends entirely on the design or the type of reverse gear itself.

"Exam. ROGERS. What I am getting at is what would be the maximum change in cut-off before the air would take care of it?

"A. That again depends on the cut-off at which the locomotive happens to be working, because an inch movement, or a quarter of an inch movement in thirty percent cut-off changes the cut-off to a very greater extent than a quarter-inch movement will at 75 percent cut-off.

"Q. Is that so with any of these gears that you have described here so far in your testimony?

"A. All except one.

"Q. Which one are you referring to?

"A. I mentioned one.

"Q. We will come to that later. That is one you have not described, is it not?

"A. I mentioned it. I don't know whether it has been described.

"Q. Limiting it to the type A and B Ragonnet, and the type B Ragonnet, or Franklin, as it is now called, on the precision?

"A. Precision of the D and F–1 type.

"Q. Yes. With any of those you have this constant variation of the position of the piston in the power reverse cylinder, as the locomotive moves over the road whenever the alternate pull on the valve gear on the power reverse piston through the tumbling shaft and connections is sufficient to overcome the friction between the parts of the gear itself, as you have mentioned?

"A. There is not a constant variation, no; but it occurs whenever the pull is sufficient. I have ridden engines 15 miles an hour
1779e without a movement discernible on the indicator. Vibration, of course, shows on any indicator, but any real movement is what I mean in a type E gear.

"Q. It is intermittent?

"A. It is and depends on variations beyond the control of the reverse gear quite frequently, not always, but quite frequently.

"Q. When you get to a point where the locomotive is working harder, there is necessarily more strain on the parts and you might experience more of this travel?

"A. For any given cut-off, the higher the speed the more strains there is. It is a thing that is dependent on the weight of the reciprocating parts and the speed with which they move, insofar as that end of it is concerned. It is also dependent on variation in air

pressure. If you get variation in your reservoir pressure, the reverse gear will have to adjust itself to that variation; increase or decrease.

"Q. And the normal action of these valves on the air reverse and the rest of the mechanism, when it is in 100 percent operating condition, is that whenever the strains are encountered the piston first moves and then the action of the valve, when the piston is moved far enough, controls the air pressure.

"A. It is nothing but a governor. You have to move the mechanism before the mechanism can readjust itself to the altered condition.

"Exam. ROGERS. How long does it require for the gear to make that adjustment within itself?

"A. As I mentioned, the precision gear does it very much more apparently than the type E gears, and it depends upon the extent of that force.

"Exam. ROGERS. What would be the maximum, can you tell us?

"A. Sometimes it may require a cycle of two minutes or so, a complete cycle. I don't know what the maximum would be. Other times, it is very rapid.

"Exam. ROGERS. You think two or three minutes would cover it?

"A. I don't know. I have not experienced all the conditions that could occur.

"Exam. ROGERS. I understand that.

"A. I am talking about lever type gear when I say three minutes, not the precision. That is due to abnormal conditions, as a rule, and not normal.

1779f The type A Ragonnet has a longer valve than the type B. The type A had a 1/8 inch exhaust lap originally, changed later to 1/16 exhaust lap, and then back again to 1/8 inch. The admission lap was originally 1/32; now it is a negative lap, minus 128. Explaining the difference between positive lap and negative lap the witness said: "Consider a slide valve, having two ports, one leading to either end of a cylinder, and consider that valve lying on top of those two ports so that it covers both—there you will have a positive lap. You consider it so that it only covers a portion of both and all of one and not all of the other, and you will have what we term a negative lap."

"Q. Speaking with reference to the operation of the precision type of gear with no steam or with no air in the cylinder, you likened it to the operation of a reversing gear with the hand screw type of appliance?

"A. Yes.

"Q. There is this difference, however, is there not, Mr. Zouck, that the hand screw type has a larger wheel and is set up with a somewhat different adjustment of screws and so on, with the idea of using it at all times for that purpose, whereas your Franklin type is a smaller wheel and it is only presumed to be used in emergency without air?

"A. That is the object, of course, to use it in an emergency, but it may cause steam connections to be unnecessary, because quite frequently you find in a case of air failure your steam also fails. Ordinarily if you break an air line your steam line breaks too, but by this the air can be removed entirely.

"Q. But it does not move as easily as a hand screw type?

"A. When you operate the precision gear with air all the operator does is move the valve.

"Q. Yes.

"A. Relative to the piston. When you operate it without air he has to move the entire valve motion manually and include the friction of the gear itself, so it is very much harder.

"Q. It is very much harder than a hand screw type of gear?

"A. I don't know how much harder it is.

1779g "Exam. ROGERS. The witness has not gone into that feature. He said the precision worked on the same principle as the hand screw.

"A. It is really possible to do it and it is frequently done.

"Exam. ROGERS. What did you mean when you said that ordinarily if you broke an air pipe and all that sort of thing, you would break your steam line, too?

"A. The steam usually runs into the air line and the valves on either side. You do not have two lines, as a rule, to the gear itself. You have one line, into which both the steam and air go.

"Exam. ROGERS. Where would the air pipe have to break in order to do that?

"A. Somewhere near the gear, between the point that the steam is led into the air line and the gear.

"Exam. ROGERS. Where is that point?

"A. That depends largely on the particular application.

"Exam. ROGERS. All right.

"A. Somewhere on all of them. It may only be 6 inches long, or it may be 5 feet on one.

"Exam. ROGERS. Any further questions of this witness?

"By Mr. MOREHOUSE:

"Q. I would like to ask you this, Mr. Zouck, and if you don't know about it, all right. I don't know whether you do or not. I would like to ask you whether or not it was not the principal purpose of your company in developing this new type which you call the precision, to try to overcome the trouble that had been experienced with creeping on the other types you previously mentioned.

"Exam. ROGERS. That is on the Ragonnet.

"Q. Ragonnet and Franklin and the other types that you mentioned?

"Mr. STEVENSON. We object to it. There is nothing in the record that we went into about this witness knowing anything about creeping. We did not go into that matter with this witness.

"The WITNESS. Will you read the question?"
(Question read.)
"A. The precision type of the three types we have been discussing, three models, would be better, was designed to obtain a
1779h maximum micrometer adjustment, we will say, at any point of cut-off, which we felt had not been possible with the earlier types.
"Exam. ROGERS. The question is—do you know whether in developing the precision type that the principal purpose was to overcome the creeping in previous types?
"A. Well, I don't know. I am afraid I will have to ask exactly what creeping is. I expected to go into some other points. If you cannot designate creeping, I cannot answer very well (T. 6363-6373)."

1779i G. P. ROBINSON

DIRECT EXAMINATION

Witness Robinson stated that he was a resident of Glen Ridge, N.J., and that he was sales manager of accessories for the American Locomotive Company; that he had jurisdiction over reverse gears, and that he has had experience in both manufacturing and engineering in connection with reverse gears. His company markets a reverse gear under the trade name "Alco." He stated that their latest type gear was type G, which comprised 90% of their present output. We made the first reverse gear and put it on the Mallett in 1904. That is known as the type A gear, or the Mellin gear. That gear had an oil dash pot and an air cylinder, with the reverse lever in the cap; somewhat similar to the Johnson bar.

A short time afterwards we made the types B and C, which you probably are not interested in. The type B is used exclusively in South Africa. Then we adopted from Europe the screw gear, which was used for a short while and abandoned. In 1914 we brought out what is known as the type D gear, which is somewhat similar to the present gears, with the exception that there is no air on either side of the piston, except when you are trying to reverse it. The valve was arranged so that the air was exhausted immediately after the engine was reversed. It was necessary in that case to have a locking device on the guide, but the engineer wired the locking device and made it inoperative, and that was abandoned, and then there were three or four types of that gear, until we got down to the time of the Railroad Administration and brought out the D-4 type, which had a valve on it almost exactly like the present valve, which is a rotary valve. The first type of D gears had the square packing, hemp packing, you might call it, which was abandoned, and the Railroad Administration made the mistake of requiring all gears to have metal packing. They were used only as long as we had Railroad Adminis-

tration, and in connection with the Johns-Mansville Company, we developed the cup packing, which is the standard on most gears at the present time.

The next development was to redesign the D–4 gear, in 1918
1779j and 1919, and take off the lock on the guides and use a valve which had a slight outside admission lap. I think it was one-eighth of an inch to begin with, and our experience was such that we cut that down to line and line. Then we found it was necessary to get the best results to cut the line and line admission to one-thirty-second clearance on negative locks. After a large number of these gears had been put on the market we found it desirable to make a slight change in the design by taking off the pipe leading from the valve to either end of the cylinder, so that in repairing the valves, you would have no trouble in putting the pipe back in back. That is for convenience. We took advantage of this change in design and revamped the entire valve, making it 83 percent faster in operation and called it the G type. Practically every part of the G gear is interchangeable with the E gear. We have no change to the thousandths of an inch in the size of the pins but we have made a change in the laps of the valve and the materials used. When we started the admission lap of ⅛ of an inch, we found when there was a leakage from either end of the cylinder, that the cross head would have to move a sufficient distance to overcome the lap of the valves. Then we cut the lap down to line in line, which is theoretically proper, so that the cross head would move just a trifle before the valve would move and admit air on one side to balance the pressure, but we found practically that there is wear on other parts of the valve, which allowed the valve to drop slightly and instead of being line in line, we would have actually a 64 positive lap. Therefore, by experiment, both in the field and in the shop, we made a 32 negative clearance in order to overcome this defect. The purpose of it is so that the two ends of the cylinder are in direct touch with the air in the main reservoir. The actual operation is that the pull down on the valve motion, together with the piston rod area be different, at the front and back. The little valve pulls itself over and actually closes on one side and admits a little more air on the other side. We have put out about 11,000 of the E and G types, of which I imagine there must be about 4,000 or 4,500 of the G's.

"Q. You regard that change and the other changes that
1779k you have testified about as improvements?

"A. It was necessary for us to make them to keep the gear from creeping.

"Exam. ROGERS. Do you have any knowledge or any way of knowing, Mr. Robinson, whether you accomplished your purpose when you set out to prevent the creeping?

"A. Yes, sir.

"Exam. ROGERS. How did you make out with it; did you stop the creeping?

"A. Yes, sir. If a company says their gear is creeping, I examine the gear, making sure that the valve is as near perfect as it can be when it left the shop. I do that with a master gauge to make sure that the packing is tight and there are no leaks. In other words, I repair the gear as it should be, and then I ride the engine with a wire attached to the crosshead of the gear so that if there is any movement of the gear it will be indicated in the cab.

"Exam. ROGERS. How many engines have you ridden in any recent period to determine that?

"A. I rode two about ten days ago. I ride about four or five a year."

CROSS-EXAMINATION

Type E was the result of our redesigning type D–4 in 1919. The difference between the E and G is the piping arrangement and the lap in the valve. As to the change in the piping arrangement, that was the incidental change of taking the piping off. You have your core to the top of the cylinder. This was done for maintenance purposes. With the G you can exhaust the air 83 percent quicker. We changed the edges of the ports in the valve from a round hole to a square hole so that you would get a very quick opening. It makes a quicker acting gear. We are now using exactly the same cylinder packing we used in 1915. Our gear is made up of fifty-four different parts (T. 6373–6383).

In some of the earlier gears the first packing was square hemp packing, which is very hard to maintain; the next was the cast
17791 iron rings which would leak more when new than packing leaks when worn. Then the Johns-Manville cup packing, which is 5 layers of asbestos fibre with a proper vulcanization.

"Q. Now, it is your idea, Mr. Robinson, I take it, from what you said, that this new type of valve has resulted in eliminating the creeping?

"A. I wouldn't say that a new type of valve eliminated the creeping. It is putting a negative clearance or clearance which eliminates it. We have had no complaint of creeping with that.

"As I understand creeping, it is when the cross head of the gear moves down one or two notches, and in some severe cases the cross head would move an inch or an inch and a half without a movement of the lever in the cab. Then the valve is moved and the gear jumps back to its original position, or perhaps a little bit behind it, and then starts out again and does the same thing in regular cycles 4 or 5 times a mile. This was brought out in tests made on our own and 18 other types of gears in 1919.

"Exam. ROGERS. That is what you call creeping?

"A. That is what we call creeping. There is no creeping in our gear at the present time that results that way.

"By Mr. MOREHOUSE:

"Q. That is, so far as you know?

"A. I mean that comes to our attention.

"Exam. ROGERS. How long has it been since you had a complaint as to creeping on your gears?

"A. Well, they use the word 'creeping' when anything is wrong with the gear.

"Exam. ROGERS. What I am talking about is how long has it been since you had a complaint where you found creeping, or creeping as you defined?

"A. Three weeks ago, but it was not the gear.

"Exam. ROGERS. When did you have the next one ahead of that; do you recall?

"A. I think perhaps some time last winter. I don't recall but one case this year, but that was not the gear.

"As I remember there may be 4 or 5 complaints a year to our company concerning creeping. We have put out from 4,000 to
1779 4,500 locomotives equipped with the type G power reverse gear.

"Mr. MOREHOUSE. So then your statement is made on the supposition everything that was reported to other representatives was brought to your attention?

"A. Yes, sir. Sometimes it is very difficult to say what a complaint is because a man says his gear is creeping, and you merely go there and show the man a simple operation and it is over with. There is rarely any record made of it. Probably that might happen.

"Q. You went to the Baldwin Locomotive Works and supervised the application of certain of your type G gears to the class H locomotives that were being built at that time for the Chicago and North Western Railway, did you not?

"A. I can hardly say the supervision. I merely looked over to make sure that they were applied reasonably well.

"Q. You checked them over to see that they were properly applied, did you?

"A. Yes, sir.

"Exam. ROGERS. When was it, do you recall?

"A. It was some time last year, I think, or the year before, maybe.

"Q. About November 1929?

"A. It is a little over a year ago.

"Q. Now, I would like to ask you if you are familiar with the following complaint that was made by Mr. E. B. Hall, superintendent of motive power, of that company, to your Mr. N. C. Naylor, vice president of the American Locomotive Company, at Chicago, on or about May 28, of the present year. It reads as follows: 'Our class H locomotive 3002 had to be taken off the run by Fuel Supervisor Jeffers on account of power reverse gear going to the corner in forward motion. This would happen each time the speed was

increased to 50 miles an hour or better. Engine was taken off at Nelson. A copy of Mr. Jeffers' report is attached. Something will have to be done with these power reverse gears so that we can hold these engines at high speed', and attached to that was a report by Fuel Supervisor Jeffers, under date of May 22nd, 1931. Was that brought to your attention?

"A. I presume it was. We heard from them once or twice.

1779n "Q. Do you know whether or not one of your service men, Mr. Robert Brown, was sent out to ride engines of that class, class H, and following the receipt of that complaint?

"A. He probably was sent out. I don't know whether he rode any engines or not.

"Q. And was this complaint brought to your attention, contained in a letter of June 2nd, 1931, from Mr. Hall, addressed to the American Locomotive Company, McCormick Building, Chicago, in which he stated, 'We believe the power reverse gear creeping has something to do with the breaking of valve gears on these engines', referring to the class H engines.

"A. I never heard of any valve gears breaking on account of it. They broke a little lock on the reverse gear.

"Q. Do you know whether that complaint was brought to your attention, that particular one?

"A. Something similar to that. It was probably the same thing.

"Q. Do you recall whether or not this complaint was brought to your attention, contained in a letter from Mr. Hall to your Mr. N. C. Naylor, vice president, at Chicago, under date of June 23, 1931, referring to the class H engines again?

"Exam. ROGERS. These all relate to the same class of engines?

"Mr. MOREHOUSE. Yes.

"A. It is the same running correspondence.

"Q. 'Some action will have to be taken by your company, and very promptly, to overcome power reverse gears creeping if we are to maintain these power reverse gears in service. Irrespective of repairs, which are altogether too expensive, these power reverse gears do not hold, in other words, they creep, which causes an extravagant use of fuel. We have tried to be patient in this matter, but we do not seem to be getting anywhere. We will appreciate it if some action can be taken to make these gears positive in their performance.' Do you recall that?

"A. I could not remember detailed correspondence, but we had such a general complaint, but on the other hand it may not have been reverse gear trouble.

1779o "Exam. ROGERS. Do you have there, Mr. Morehouse, anything from the representative of the American Locomotive Works as to what they found?

"Mr. MOREHOUSE. Not with respect to those complaints, other than letters from Mr. Naylor, acknowledging receipt of them and saying he would send Mr. Brown out to ride the engine.

"Exam. ROGERS. But you do not have anything from Mr. Brown as to what he found?

"Mr. MOREHOUSE. No.

"Exam. ROGERS. Any further questions?

"The WITNESS. When I said we had the one complaint, I thought a little further back; we have four or five a year. I could not remember the one but two weeks ago. There may be four or five a year.

"By Mr. MOREHOUSE:

"Q. Do you recall, Mr. Robinson, whether or not certain complaints were made by the Wabash Railroad with respect to some of their later power with the type G Alco gears on them, and it was brought to your attention?

"Exam. ROGERS. Do you have any idea what it was?

"Mr. MOREHOUSE. It is on the 0–1 engines, between October 1930 and June 1931, or, I will say, up to the present time.

"The WITNESS. Since I have been in the building here the gentleman mentioned it.

"By Mr. MOREHOUSE:

"Q. You had not received the complaints?

"A. If he did make it, it made no impression on me.

"Q. Is your company at the present time, Mr. Robinson, working on a design of entirely new type of reversing gear?

"A. Yes, sir."

C. L. MELLOR

DIRECT EXAMINATION

Witness Mellor testified that he was a resident of Winnetka, Ill., and he is the vice president of the Barco Manufacturing Company and has general supervision of any engineering duties of that company. He stated that their company market a power reverse gear known as the "Barco power reverse." The first gear we put out, known as the "B–1", had a double cylinder, with a worm in between; the B–2 gear was 7½-inch cylinder and later we decided to go to ten-inch cylinder and came out with a B–3. In 1927 we came out with the B–4, which has the same basic design, except turned around in certain ways to overcome some points we thought were the weaknesses in the former types. We put in larger studs. We later changed the quadrant, giving twice as many movements, or twice as fine adjustment of the cut-off; we later changed the cup gaskets or sea rings, making a square heavy head at the top to increase their life. As the engines were made larger we strengthened the thrust bearing cap. We changed from fibre thrust bearing washers to hardened steel. We have recently made slight changes in our valve, which are on test at this time, to reduce whatever movement there might be in event of lost motion from wear in the various parts. We have greatly strengthened the connection between the valve arm

1779p

pin and the valve to prevent lost motion developing between those two points; also increased the diameter of that valve pin which holds the valve mechanism in our later design of gear. I don't believe we have more than 200 B–4 gears in service, nor more than 100 B–2's. There are probably 500 B–3's.

CROSS-EXAMINATION

"By Mr. MOREHOUSE:

"Q. These tests which you mention, Mr. Mellor, I take it, have not as yet progressed far enough for you to know definitely what the result will be?

"A. However, the tests on the valves have only been for a short while. The first was put on in June and the other in July. So far as we know at this time they are satisfactory. Within the last three weeks we have been starting a different style valve on another railroad. Our company is working on a design of a new gear at the present time."

(Exhibit 105, Witness Wyatt, was received in evidence.)

E. A. SCHMOLDT

DIRECT EXAMINATION

Witness Schmoldt stated that he was a resident of Madison, Wis., and that he was employed by the Chicago and North Western 1779q as an engineer, and first began running an engine February 10, 1906. At the present time he has a regular assignment between Madison, Wis., and Harvard, Ill., operating the class Z type of locomotive equipped with the Also power reverse gear. For a great many years previously he operated the class R–1, a 10-wheel locomotive having a little over 100,000 pounds on the drivers and equipped with manual reverse gear. I know Engineer F. C. Meyer and am familiar with the runs which he has and with the engines he has used. He uses a class R–1 engine, the 1131, which is his regularly assigned engine, but they get mixed up and he runs practically different engines of the R–1 type. I am speaking of the last six years. I have operated those same engines during that time on his regular assignment.

"Q. Will you describe the location of the reverse lever on engine no. 1131, which Engineer F. C. Meyer operated—that is, with reference to the place where the quadrant is and the seat box?

"A. They are practically the same on all R–1's. The quadrant and lever on that type of engine are located directly behind the boiler head on the right side near the right seat box. The seat box is stationary. The clearance from the lever to the window sill of the cab is approximately 19½ inches; between the lever and the edge of the seat box it is 3 to 4 inches. The forward end of the quadrant is

3 or 4 inches from the boiler head. The piping from the main drum train line and various appurtenances, such as the auxiliary reservoir, comes between the boiler head and this lever when the lever is in full forward motion, making a clearance of about 4 inches between this lever and the piping."

If you were to operate the lever by straddling the quadrant—I mean putting one foot at either end of the quadrant, and sitting with your back toward the window, the lever would touch your leg if it were placed in forward motion; my foot and leg would be directly in front of the reverse lever. There would not be room to withdraw my foot to any extent from the position I have just described and bring it farther away from the quadrant. The width of the seat box between the seat box and window is very small, about 19 inches, and if I sit that way the lever comes in contact with my knees. Sitting in that position you would have to cramp your knees to provide a clearance for the lever to pass if you didn't want the reverse lever to hit your foot. You could leave the foot out there where the bar would strike it, and it would not interfere with the knees. I have had the lever come in contact with my knees and have torn holes in my overalls. In full backward motion the top of the lever may be extended approximately 6 inches beyond the backboard or out in the gangway. There is a half-moon shape cut out of the backboard to make provision for your hand to pass through between that and the lever.

1779r

A copy of the company's instructions on the subject on where to place your feet in operating the reverse lever was thereupon offered in evidence marked "Complainant's Exhibit No. 106, Witness Schmoldt." (The exhibit was received in evidence.)

I have used the Z engines in regular assignment since January 1, 1930. I have not had any experience with creeping of the power reverse nor have I noticed any increased fuel consumption on account of improper performance of the power reverse (T. 6399–6409).

On one occasion the power reverse seemed to reverse itself very rapidly, and on arrival at the terminal I reported it in some such language as jumping, but later on I found that it was not the fault of the gear but of myself. I had the engine hooked up altogether too close; I had the valves cut up too high; the admission ports were almost blank and running off; and I noticed that the exhausting from the power reverse exhaust was similar to an automobile running along with the exhaust open. I noticed the link block jumping. Then I closed the throttle, unlatched the latch, and dropped the reverse lever down carefully, and pulled the throttle open, hooked her back, and everything was normal. After I made the report about the jumping the mechanical man at the roundhouse went over the power reverse and found nothing wrong. So the next time out on a trip I wanted to demonstrate to my own satisfaction as to what would cause this jumping, and I found out that if I run her the same way as I did on the trip before, hooked her up too close, I got the same jumping.

1779s The bulletin covering company's instructions to engineers on how to operate power reverse gears was thereupon received in evidence marked "Complainant's Exhibit No. 107, Witness Schmoldt."

CROSS-EXAMINATION

This particular experience that I had concerning jumping was on engine no. 1780 on February 24, 1931, and I cut her up closer because I had a lighter train and by working with as short a cut-off as possible I would use less steam and was trying to save coal.

"Q. But you found with the power reverse on this engine 1780, you could not hook up as short as you wanted to from the fuel standpoint because of this tendency to reverse itself when you got up there; is that not correct?

"A. I was simply experimenting to see how close I could work a power reverse engine, and I really believe I had the valve blanked. I don't think any steam was working when this occurred. On several occasions I have reported work on the various appurtenances to the gear, such as leaky pistons, leaky piston rod, stuffing boxes and oil cup trouble on the reverse gear (T. 6409–6419)."

If the leakage is permitted to go on indefinitely without any attention and becomes great enough I presume that the piston in the power reverse cylinder will not stay where it is set. At least bulletin No. 2010–A of the American Locomotive Company states that (R. 6420). I reported it immediately when I discovered a little leak so that it would be repaired. When the wind was not blowing badly I would go over it with a torch. The only way I could tell on a windy day is to take an oil can and drop oil down, and if the oil would blow away I would find a leak. In way service when we are stopping to unload freight I don't think there is a station where I am not down looking at some parts of the locomotive. At the particular time when the gear reversed itself I heard the noise from the power reverse which was similar to an automobile with the cut-out wide open but I could not detect any noise from the stack. When I observed this performance I immediately closed the throttle (T. 6419–6429).

1779t W. V. JOHNSON

DIRECT EXAMINATION

Witness Johnson testified that he was a resident of Pekin, Ill.; that he was hired by the Chicago & North Western in 1892 and promoted in 1898 and has been on the Southern Illinois since 1913; that he is on a time freight run between South Pekin and Nelson and sometimes in helper service between Peoria and Radnor. He stated that the class of power on those assignments are the class J–4 and 2–8–4 and that these engines are equipped with Barco power reverse. He stated that they have speed restriction of 30 miles an hour but

occasionally exceed that at different points and that their tonnage usually runs from 3,800 tons to 4,100 tons, but sometimes reaches 5,000 tons. I have had very little trouble with power reverse creeping. I only remember one occasion, but there may be others, I don't recall, as I didn't keep any record of them, that was on the 2804—helper job—and she went irregular in exhaust and up the hill, of course, she was working hard. When I got in I reported the thrust notch on the worm gear needs tightening up and it was corrected. I recall another occasion with 2809. I noticed the levers that were set on the quadrant would drop down very slowly, just a nick at a time. I had no spring on the reverse lever latch. I have not noticed any increased fuel consumption on these occasions of power reverse creeping. I made no particular observation or particular effort to observe fuel consumption on these occasions when I did have creeping (T. 6432).

Leo F. Cloud

DIRECT EXAMINATION

Witness Cloud stated that he first entered the employ of the New York Central November 11, 1925, as a fireman and that he was still firing class of engine known as the Consolidated type, 2–8–0; that these engines are equipped with the Baker manually operated gear.

On October 27, 1930, I was firing the 9702. We headed down into a track on some cars and my engineer asked me to get down and observe the movement of the counter-balancing spring to adjust the spring. I got down and placed my hand on the bell crank frame in order to pull myself up to get a view of the spring. I asked the engineer to reverse the engine, not realizing the 1779u position of my hand. When he reversed the engine it caught my little finger between the reversing arm and the gear frame breaking the bone. I was off a little over three weeks, the company paid my doctor and hospital bills and settled with me for $85 (T. 6429–6439).

CROSS-EXAMINATION

I had my hand on top of the gear frame at the back end and knew the other man was going to reverse the engine. If I had stopped to think I would have known my hand was in the way. I had it down at the end where the reversing yoke came up against my finger when it reached the end of the swing. In other words, when the movement was completed and reached the end of the swing, that was the point where this yoke came up against my finger. I don't know exactly how close the yoke would come to the frame at this point if my finger had not been there; in other words, I don't know exactly how much clearance there was. I did not know at the time my finger was broken, but it began to swell up. The following day

the doctor instructed me to get an X ray and thereafter informed me of the fact my finger was broken. It was not a break that could be determined by movement but simply by observing the X ray (T. 6435–8).

E. J. WHIPPLE

DIRECT EXAMINATION

Witness Whipple stated that he first was employed by the New York Central as a fireman June 24, 1916, and that he was promoted to engineer November 19, 1919. On October 27, 1930, asked Fireman Cloud if he would go down on the ground and watch the counter balance springs and rods inside of the counter balance box. I asked him to watch it so when I hooked the engine over to see if I could adjust the spring with the wrench. I told him when he got ready to holler, and I would reverse the engine. He says, all right; I reversed the engine and looked out the cab window. I seen him standing there, and the expression on his face was such that I knew there was something wrong. He commenced moving his left hand, and I hooked the engine up to center as quick as I could and jumped down. I went to him and took his glove off. His finger was not mashed open but it was red. Another fireman was called out. In moving the lever I did not feel any obstruction that would indicate that anything was caught in the valve gear. This
1779v was a manually operated reverse. I have had times when you pulled the engine back and there may be steam in the cylinders, and you came back almost to center and it is like an air cushion. I have pulled her ahead, that is, put more power on it, and then jerked her over, and she came back all right. The witness stated that it was his practice in reversing an engine from one corner to the opposite corner to pull it over very rapidly.

CROSS-EXAMINATION

On this occasion I had the lever hooked back, and you get it to center and then start back and it would come easy, but when you want it to come forward you have to put your weight against it to get it down.

"Exam. ROGERS. When you went forward with it, did you take it down gradually or shove it ahead?

"A. You would not take it down gradually. You had to put your weight against it, push it down.

"Exam. ROGERS. Did you put your weight against it in shoving it down in the corner?

"A. Down in the forward motion."

This time she would not come back in the corner. She came back in the back motion, clear back as far as she would come.

"Q. Do you know whether it was back as far as it would come if Mr. Cloud's finger had not been down there?

"A. It came back as far as it ever came."

W. H. CALAME

DIRECT EXAMINATION

Witness Calame stated that he lived at Omaha, Nebr., and was first hired by the Union Pacific in 1912 and promoted in 1918. He stated that he had experience in yard service and also main line road service from Council Bluffs to Grand Island and operated the 5,000 Santa Fe class and 1,400 Mikado type. The Santa Fe type are 297,000 pounds on the drivers and are equipped with Barco reverse gears, while the Mikados weigh 214,000 pounds on the drivers and are equipped with Alco, Ragonnet, and Barco gears. I know Fireman A. Beach of our road. He has fired for me on the run I have just mentioned probably three or four times.

1779w "Q. He testified in this record that power reverse tears holes in the fire when the gear is creeping and he burns three to five tons of coal extra when the gear is creeping as compared to trips with no creeping. Have you ever had that experience with either Fireman Beach or anyone else?

"A. No, sir."

I have had a creeping gear to some extent. I can't give you the number of cases, but it was very little. It crept just as though you would let the lever down a notch or two. I would usually pull it back up and then set her down a notch and ease my throttle. I have never noticed any extra amount of coal being used when the gear is creeping.

On September 18, 1920, I was switching with 4411 a six-wheel switcher weighing 156,000 pounds on drivers having a manual reverse gear. The witness stated that the engine stripped herself and broke his leg.

By Mr. MCLAUGHLIN:

"Q. Mr. Calame, I wish you would describe the location of the lever and seat box and tell us in what position you were just prior to and at the time of this accident.

"A. Well, I don't know whether I can get it anywhere near right. I think I can. I was seated in the normal position. I was sitting facing, so if this was the gangway, why, here is your boiler head and the reverse lever goes between the boiler head and engine. I reached over and got the reverse lever and pulls it over in back motion. That comes up against your leg. I had hold of the throttle kicking cars back and looking out of the back window in normal position.

"Q. Is there any other way you can operate it?

"A. You could by sitting straddle of the lever and looking backwards.

"Q. What would be the position of your left leg with reference to the lever when it is put in back motion?

"A. Right up against it; when the lever is against the stop block.

"Q. Will you tell us what happened on this occasion?

"A. Well, the crank arm came off on the left side when that happened, the reverse lever breaking the brass cup that holds the latch down in the corner, breaking that off, and it went to forward motion and then the eccentric arm dropped, throwing the reverse back and hit me on this side of the leg, knocking a bone out
1779x through my overalls on this side.

"Q. In what position had the lever been just prior to the accident?

"A. It was in a back-up motion, but as soon as the accident it (the lever) moves ahead. The cuff was broken off the latch, leaving the latch loose so the reverse lever could wobble backwards and forwards.

"Q. Did it wobble backwards and forwards?

"A. It did.

"Q. How many times?

"A. I don't know.

"Q. More than once?

"A. Yes.

"Q. What position was your leg left in after that?

"A. Well, as soon as I looked at it my toe was where my heel was. I sat there and looked at the bone sticking out of my overalls, and then I grabbed my leg, turned it around and the bone slipped in and that is when the pain started.

"Q. Then what did you do; what happened?

"A. The fireman ran down and told them the engineer was hurt, and they brought a stretcher up and took me to the hospital. As a result of this accident I was in the hospital 68 days. The hospital and doctor's bills were paid from the benefit fund. I was off duty nearly six months and the company paid me $2,000 (T. 6439–6449)."

CROSS-EXAMINATION

Before the accident I was sitting with my back to the window; that is normal position when you are switching cars backwards. My right leg was injured when the lever was in backward motion; it struck it. This lever is mounted alongside the boiler and forward of the seat box. It is not one of those types that is along the left side of the seat box as you face forward. It is at the side of the boiler head. In back motion the stop block is very near to the seat and the whole sweep of the lever is located in front of the engineer's seat box. When the reverse lever is in reverse motion, the center part of the

lever comes right within 3 or 4 inches of the front corner of the seat box which is nearest to the fire door of the locomotive. I do not know how much the clearance is between the swing of this lever
1779y and the outside of the cab window on the engineer's side, but it is somewhat greater than the width of the seat box. It is a drop seat. It is not mounted so you can slide it further towards the rear of the cab; it is mounted on the side of the cab. There is room in the cab so it could be set further towards the rear if desired. You could move it back a foot, but you would have almost to get up to get hold of your throttle and brake valve.

"Exam. ROGERS. You would have to step?

"A. Yes, sir.

"Mr. MOREHOUSE. You mean you would either have to get up or lean over to reach your throttle?

"A. You could not watch signals and get hold of your brake or throttle if it was any further back. At the time of the accident I noticed in an instant the locomotive went lame; then I got a lick on the leg. It was the breakage of the latch on the reverse lever that permitted the lever to move (T. 6450–54)."

By Mr. MCLAUGHLIN:

"Q. I would like to ask about the eccentric crank arm. What did you observe with reference to anything unusual in the valve motion or the parts outside the cab at the time this accident occurred?

"A. In an instance (instant) she went lame and then I was struck on the leg. It was the breakage of the latch on the reverse lever that permitted the lever to move (T. 6449–6465)."

L. D. PARMENTER

DIRECT EXAMINATION

Witness Parmenter stated that he was a resident of Omaha, Nebr., and stated that he was general chairman of the grievance committee of the Brotherhood of Locomotive Engineers upon the Union Pacific. He has been on the general committee since 1921 and chairman since 1926. The witness stated that he was first hired by the Union Pacific on August 19, 1904, and later resigned but returned to that road as an engineer April 6, 1906, and has been employed as an engineer for about 10 years with the exception of one year and three months when he was in military service in 1918 and 1919 (T 6465–6466).

1779z "Mr. MCLAUGHLIN. May I ask counsel if upon examination of the matters and papers that we have he will be willing to stipulate that a request was made by the general committee of adjustment of the B. of L. E. for power reverse on all locomotives of the Union Pacific in the year 1927?

"Mr. MOREHOUSE. My information does not go to that extent.

"Exam. ROGERS. What is your information?

"Mr. MOREHOUSE. My information shows that there was a request made for power reverse gears on 150 Consolidation locomotives of the 200 and 300 class, weighing 190,000 pounds on the drivers, and that 60 of these have since been changed to switching service, and the Union Pacific agreed to the application of power reverse gears to the 60 switchers.

"Exam. ROGERS. When was that?

"Mr. MOREHOUSE. Since 1927, but it does not show when they did it. It must have been since 1927, because that is information I have as to when the general request was made, and that as reverse gears were taken off from heavier engines they gradually moved them over onto these particular engines that are being put in switching service to the extent of 60 engines, and denied the request as to the remainder."

1779aa I am familiar with the design of locomotive 5089 on my road. I have read the testimony of witness, W. H. Bailey, who testified in this case at page 5895 of the record concerning a locomotive which ran away down a mountain between Wahsatch and Ogden. This locomotive at the time of the accident had the Young valve gear. With respect to this accident I will say that the speed of the locomotive has nothing to do with it. I can get all the data I need to pass on this question from the record and do not have to depend on what Mr. Bailey told me. I base my opinion upon the mechanical construction of the engine.

"Q. Mr. Bailey testified at page 4900 of the record that if engine no. 5089 had been equipped with hand reverse gear he would have been able to have stopped it on a descending grade when the locomotive ran away down a mountain between Wahsatch and Ogden, Utah. In your judgment would it have been possible for him to have stopped the engine by any action of manual reverse?

"A. No. I say that because of the mechanical construction of that valve gear. The left main pin governs the action of the right valve with this motion (Young valve gear). The right main pin governs the action of the left valve. The left main rod of that locomotive was gone, which would have stopped the action of the right valve. The engineer had no main rod to counteract the rotation of the wheel on the left side if he could have reversed the left side of the engine (T. 6465–6475)."

If you reversed that engine you could get very little motion on the right side, if any. With the left rod gone I don't think you could, not to speak of, at all, to do any good, if any at all (R. 6473–6474).

CROSS-EXAMINATION

If you will allow me to explain, the action which controls the valve gear comes directly off the cross head. If anything breaks down on the main rod, there is no way you can block the valve to

bring the engine in on one side unless you substitute a rod. The Young gear people furnish some rods that can be put on on the main rod and touch (attach) it to the bottom of the link
1779bb foot. These were not furnished to our road. The main pin would stop the movement of the cross head, which would stop the movement of the rod connected with the bottom end of the foot link. If the main rod was broken, the piston would not move with the wheels turning on the engine. There is no connection between the main pin and the piston or cross head, the only thing that moves the valve gear is the cross head.

"Q. Regardless of the breaking of the main rod, with the hand reverse lever he could change the position of both links with the hand lever?

"A. There would not be a particle of difference in a hand lever, because they have got a double reacher arm from the cab to your bell crank and you would have to have that on a movement to reverse, just the same as they would air reverse in order to get this movement of the valve to raise and lower the link block in the link. The right side of that locomotive would have been inoperative on account of there being no motion to the valve when the left main rod was broken. The engineer couldn't block this engine with the main rod standing still so that he could bring the engine in on one side.

"Exam. ROGERS. If the engine is standing still can you reverse the engine with the lever in the cab?

"A. You can reverse the lever, but Mr. Examiner, with your valve gear, with your reversing lever, supposing the left main rod was broken, you would reverse the left valve and you would have no action of the right valve, because that becomes inoperative on account of the broken pin.

"Exam. ROGERS. Then if you could do it that way, why couldn't you do the same thing even if you were running with the main rod broken?

"A. You could probably get the motion on the left side from the right side, through the left side, but when you did that, you would have nothing to cause any resistance, and nothing to move your right valve at all when the left main rod is down when she is moving.

"Q. If you move that link block with the movement of your reversing gear, then you get a port opening in both cylinders, do you not?

1779cc A. When you move the reversing gear, of course, if this tumbling shaft was working, that would move the valve on the left side. There is a double rocker arm shaft that goes through and when you move the right link block, it goes across and to the left valve, that is the motion from the right link block to the left valve. Now, if you go to reverse this engine you could reverse the engine from the right side. The valve would travel on the left side

without any breakdown, but in the considered case you have got the main rod gone, and it might blow out your front or back cylinder head, and that is all the result you would get. You don't move the reversing, the tumbling shaft action is only to the extent which you raise and lower the link. When it comes to operating the valve on the opposite side from the right side, you get a motion across there but with the broken main rod, on the left side, which governs the right valve motion, your tumbling shaft is not moving at all and you would not be able to move that lever.

Exam. ROGERS. Of course, as I get it, as I see it now, you could hook the engine up, or move the valve with the reverse lever with your main rod broken, but you could not work the valve for operation of the engine with the reverse lever. You would have to depend on your cross head to do that?

A. Just raise and lower the link and change the cut-off, but you would get no action from your valve at all with your left main rod broken.

By Mr. MOREHOUSE:

Q. You are not prepared to state that you would not get a port opening in your right cylinder at all by moving the gear?

A. There is nothing to move the valve with.

Ex. ROGERS. Suppose you would get a port opening by moving the reverse gear, how would you get the reciprocating motion of the valve?

A. You would not have any. Mr. Examiner, you can't blank one of those engines on one side with a broken main rod and bring it in on one side, unless you have an emergency rod to fasten on the back end of the rod to this link. The makers of the Young gears 1799dd furnish such a rod but our engines were not equipped with them. You only have half the braking power with one side taken down, that is, compression (T. 6475–6485).

"WITNESS (continuing), In this case I do not concede that he had either braking or half braking power on one side. About 1923 or 1924, when I first came there to take them through and deliver them to the western division on the 7,000's, I operated an engine with the Young valve gear and I heard Mr. Young make a thorough explanation of this gear; also I was furnished books."

(Mr. Morehouse refers to frequency of various accidents shown by the B. of L. I., stating he has checked it back to and including 1916, the first year after the Act was in effect, and it shows 686 reverse gear, 802 squirt hose and 711 grate shaker accidents.)

It was stipulated that the evidence of amounts paid by the carriers in settlement of personal injuries was admitted for the limited purpose of showing the cost of the respective accidents and is not to be considered as evidence establishing negligence or lack of negligence in any case.

There being nothing further, the hearing was closed.

[File endorsement omitted.]

1780 *Statements re exhibits 1 to 10, inclusive*

Thereupon there was offered by Mr. McLaughlin and received in evidence the following exhibits:

Exhibit no. 1 is a diagram of the Alco type G power reverse gear.

Exhibit no. 2 is a blueprint showing the valve mechanism of the Alco power reverse gear.

Exhibit no. 3 is Bulletin No. 2010 of the American Locomotive Company, and will be printed separately. Its reception was limited to the cuts, diagrams, and list of parts.

Exhibit no. 4 is a blueprint of Franklin power reverse gear.

Exhibit no. 5 is a blueprint of the Franklin precision power reverse gear, showing the hand wheel and indicator arrangement marked sheet C.38211.

Exhibit no. 6 is a blueprint of the Franklin precision power reverse gear, showing a slightly different arrangement of hand wheel and indicator, marked sheet C.38217.

Exhibit no. 7 is a blueprint of the Franklin precision power reverse gear, showing the general plan and arrangement marked sheet G.38146.

Exhibit no. 8 is Bulletin No. 241 of the Franklin Railway Supply Company, Incorporated, and relates to the precision power reverse gear. This exhibit will be printed separately.

Exhibit no. 9 is a bulletin of the Barco Manufacturing Company and relates to the Barco power reverse gear, type B–4. This exhibit will be printed separately.

The reception of these last two exhibits was limited to the cuts, diagrams, and list of parts.

Exhibit no. 10 is included in its entirety under a separate cover.

1781 *Exhibit 11*

Exhibit no. 11 shows 22 reports by inspectors of the Bureau of Locomotive Inspection relating to accidents sustained by men who were witnesses for complainants and whose names are set forth on the first page of said exhibit. The several reports set forth the facts found and the conclusions reached by the several inspectors making the reports. A summary of each file follows:

File no. 18428

On December 8, 1930, on C. & A. engine no. 347, the reverse lever suddenly shifted to the front of the quadrant, catching Engineer Stone's left heel between the bracket at the front end of the quadrant and the reverse lever, badly bruising the heel. Engineer Stone made the following explanation: He had shifted the lever toward center a few minutes before the accident occurred and was leaning

out of side window facing backward in conversation with a brakeman standing in the gangway. This position placed his left foot between the reverse lever and the front quadrant bracket. There were no defects in the lever or quadrant and the engine was well lubricated. Accident was due to his failure to make sure that teeth of latch were fully engaged with teeth of quadrant after shifting reverse lever. At the time of my inspection the quadrant had been removed, and this did not permit a true determination to be made of the adjustment of the quadrant and latch at the time of the accident.

File no. 16307

On October 4, 1927, Engineer Hunt was operating D. & H. switch engine no. 1029 and, in pulling the lever back, wrenched his back, causing a probable disability of four weeks. Engineer Hunt stated that the cylinders were full of steam and in pulling the
1782 lever back wrenched his back. He did not claim the injury was caused by any mechanical defect. At the time of my investigation I tried the reverse lever, and it was my opinion that it throws over too hard. The only defects I found were the right link binding and the reverse lever latch spring too stiff for a switching locomotive. Work reports containing the following information were examined, all work being done except as noted. September 4: Fix throttle, it leaks steam so bad that the cylinders fill up with steam and unable to reverse engine; September 7: Engine is very rugged on reversing; September 13: Reverse lever throws over very hard, throttle don't shut off tight (explanation: Not leaking very bad in house, serviceable. Approved: J. Stanley, foreman); September 14: Fix throttle, lower it down so it will handle easy (explanation: Engine fired. Serviceable. Approved: Dartt, foreman); September 17: Throttle is leaking (explanation: Serviceable, leaking slightly. Approved: B. Topping, foreman); September 21: Valves blow bad. Put new balance spring in tumbling shaft and take clamps off quadrant so that lever can be used in both extremes (explanation: Slight blow. Approved: Peterson, foreman); September 25: Quadrant engine, throttle leaks bad (explanation: Slight, serviceable. Approved: Mack, foreman); September 27: Move throttle lever down, it is too high to work in the yard with (explanation: Engine fired, serviceable. Approved: Dartt, foreman); October 4: Throttle leaks and makes reverse lever throw over hard.

File no. 15152

On August 3, 1926, Engineer Stuckey was operating P. R.R. engine no. 9925 at Canton, Ohio. In reversing the engine his foot slipped off the foot brace on the cab floor, resulting in a left
1783 inguinal hernia, causing a probable disability of three months. Fireman Johnston stated that Engineer Stuckey pulled throttle out in an effort to start the train, and train stalled. Stuckey

promptly shut throttle off and started to reverse engine, but did not open cylinder cocks. In attempting to reverse engine, and bracing himself with his foot against the foot brace provided for this purpose—the engine reversed hard, due to steam in the cylinders—his foot slipped from the brace. He complained at this time of injuring himself, but did not lay off until he finished his shift, when he saw the medical examiner. Foreman Johnston further stated that he did not hear Mr. Stuckey complain of the engine handling hard, with the exception of when he was injured due to steam in the cylinders. I was unable to interrogate Engineer Stuckey, who was being prepared for an operation. In a statement secured by Road Foreman H. B. Gardner from Engineer Stuckey after the accident, Stuckey said that his right foot slipped off of foot brace and that the foot brace was worn smooth and had not been roughened up. Instructions have been issued by the enginehouse foreman to roughen all reverse lever foot braces. I examined this locomotive, and it reversed very easy without steam. After being put under steam I tried engine with the throttle open, but while I had to brace myself I could reverse the engine fairly easy. The foot brace was of $\frac{1}{4}\times 3''$ strap iron 9" high and fastened to the cab floor with screws and securely braced. The face of this brace sets at approximately a 45-degree angle, but had not been roughened and was worn smooth. Daily inspection reports were examined for July 20 to 30, inclusive, and for August 1, and nothing was reported having any bearing on the cause of this accident. Work report for August 3, after
1784 accident, disclosed that Engineer Stuckey reported "Adjust equalizing spring to reverse lever, it pulls back hard."

File no. 17295

On February 7, 1929, Engineer Speas was operating P. R.R. locomotive no. 2285 at Ardmore, Pa., when the reverse lever flew backward and broke one of the bones in his left wrist, causing a probable disability of 25 days. After leaving Ardmore, while running backward with about 15 cars, Engineer Speas was hooking up the hand-operated reverse lever when it flew backwards, his elbow striking the rear end of the cab, the reverse lever being between his thumb and forefinger, resulting in a fracture of a small bone in his left wrist. Locomotive 2285 was not held for Federal examination, but I tested this locomotive and found the valves out of square, this condition being more noticeable while locomotive was running backward. An examination of the reverse and valve gear disclosed: the reversing gear reach rod $1\frac{3}{8}''$ too long; the corners of the rear reverse lever latch worn off; the rear bolt holes of the inside and outside reverse lever latch were elongated $\frac{1}{8}''$; reverse lever reach rod jaw bolt worn; right valve rod bolt worn; left valve rod loose on stem; right and left rocker box bolts loose; left go-ahead eccentric rod strap bolts loose (3), and rod working slightly with jaw bolt loose; right and left transmission bars had $\frac{5}{32}''$ side play at rocker arm connec-

tions; right and left transmission bar hanger bolts loose at top and bottom connection with $\frac{3}{32}$" side play; right link hanger had $\frac{1}{16}$" side play at top connection; left link hanger had $\frac{1}{16}$" side play at bottom connection and $\frac{1}{8}$" at top, with bolt loose; right inside link hanger bent $\frac{1}{16}$"; right outside link hanger bent $\frac{5}{8}$"; left inside link hanger bent $\frac{1}{16}$"; left outside link hanger bent $\frac{5}{8}$". The

1785 locomotive was equipped with the Stephenson valve gear having slide valves. Inspection reports: Locomotive received last monthly inspection at Philadelphia, Pa., 46th Street Enginehouse, January 20, 1929. Daily inspection reports were checked at Philadelphia, Pa., 46th Street Enginehouse, and the following reports were noted, which may have had some bearing on this accident:

Item as reported	Disposition
January 12, 1929. Main valves out in back motion Signed—Engineer Hogerstogler	Deferred to boiler wash.
January 19, 1929. Main valves out bad	Deferred to boiler wash.
January 22, 1929. Square main valves, engine very lame in back motion. Engineer Gottschal	No notation, indicating repairs were made.
January 24, 1929. Main valves out. Engineer J. A. Sarsfield	No notation, indicating repairs were made.
January 21, 1929. Main valves out in back motion	No notation, indicating repairs were made.
January 26, 1929. Engine very lame in backward motion. Engineer Joe S. Van Osten	Deferred to boiler wash.
January 31, 1929. Examine main valves; cannot move reverse bar when working steam. Engineer H. J. Clanmens	Deferred to boiler wash.
February 4, 1929. Main valves out of square. Engineer H. W. Hargraves	Deferred to boiler wash.
February 7, 1929. Worn latches will not hold lever in position. Engineer Speas. Overhaul reverse lever latches. Inspector Buchanan	No notation, indicating repairs were made.
February 8, 1929. Main valves out. Engineer Bateman	No notation, indicating repairs were made.
February 12, 1929. Main valve out; engine lame. Engineers Patton & Neiman	Deferred to boiler wash.

1786 It will be noted from the above quoted extracts from the inspection reports, that considerable trouble was experienced with the valves out of square which, coupled with the worn condition of the gear, no doubt, was responsible for the jerking of the reverse lever which flew backwards while the locomotive was moving backward, causing the accident.

It will also be noted that the valves were reported out of square on January 12 and 19 by the engineman and reports bore the notations, "Deferred to boiler wash" and that again on the two consecutive days after the monthly inspection (January 20th) valves were reported defective.

It appears that with this repeatedly reported condition of the valves measures should have been taken to repair the defects at once instead of deferring this work to some future date.

Statements: Engineer Speas stated: "The reverse lever just flew back when he was hooking it up and upon his arrival at the enginehouse at 46th Street Enginehouse, Philadelphia, Pa., he filled out

the daily inspection report. After the printed item in the body of the report "Worn latches will not hold reverse lever in position", he put (X) thinking there might be something worn due to the reverse lever flying backward and he did not take particular notice of anything wrong with the lever prior to the accident." He also stated that he did not take particular notice of the valves being out of square that date, due to small number of cars handled in the train and, furthermore, the locomotive was moving forward most of the time.

Mr. J. H. Muntz, foreman, 46th Street enginehouse, Philadelphia, Pa., stated that "at the completion of the trip for locomotive 2285, February 7, 1929, an examination of the reverse lever was made and some dirt and grease was found between teeth of quadrant, but in his opinion, it was not sufficient to prevent latch from engaging, although it was removed.

1787 The general condition of the locomotive was fair. Cause of the accident was valves out of square and reverse gear and valve gear worn causing the reverse lever to fly backward while being operated. No doubt this accident would have been avoided had the reported valve gear defects been given the proper attention.

File no. 15476

On December 21, 1927, Engineer Diller was operating P. R.R. engine no. 4003 at York, Pa., and he was injured while handling the reverse lever, sustaining a contusion of the left lower back and side and rupture of ligaments of left lower side, causing a probable disability of one week. He was shifting cars in the classification yard and had stopped the locomotive to go ahead. From statements obtained, my investigation develops that after coming to a stop, Engineer Diller moved the reverse lever ahead from its "back-motion" position, then opened the throttle. The engine would not move due to the fact that the reverse lever was not moved far enough ahead or past its natural position. He (engineer) then closed the throttle and with some considerable effort succeeded in forcing the reverse lever over the center into forward motion, which immediately released the steam pressure in the steam chest; after which the reverse lever operated easily and, according to his statement, he could operate the reverse lever with one hand. It was while in the performance of the above operation that he sustained the injuries as stated.

In connection with the above, it was first stated by Engineer Diller to this effect, that the throttle valve came open and he did not know it was open until he went to reverse the engine and could not push the reverse lever past the center. He then closed the throttle and

1788 the fireman held the throttle lever closed while he forced the reverse bar over the center, then it flew down in the corner causing his injuries. He afterwards contradicts his own statement and states that the reverse bar did not jump ahead, but

simply moved ahead due to his effort and moved easier as he succeeded in getting it over the neutral point. This, of course, uncovered the steam ports and thus released the entrapped steam in the steam chests. Fireman Zech contradicts Engineer Diller by stating that Diller moved the reverse lever ahead and pulled the throttle open, but the engine did not move, due to he not having pushed the bar over the center. He (Diller) then closed the throttle and he (Fireman Zech) voluntarily steps over and holds the throttle lever in closed position while Diller forces the reverse lever over the center. When Zech took his hand off the throttle lever, it stayed right there. Diller states that the throttle lever would spring back about three notches on the latch quadrant, but on this occasion it sprung open 5 or 6 notches, but further states that it never did this before or after. Fireman Zech states that he handled the engine for three hours after this occasion and did not have any trouble with the throttle or reverse lever.

On the same date at 7.00 a.m., the above crew was released in the yard and engine 4003 was taken in charge by Engineer Paul Gemmill, who operated it until 2.55 p.m., turning it in at the inspection pit. Gemmill states that the throttle lever latch would not hold the lever in closed position, and when he released the latch the lever would spring back about 3 notches on the latch quadrant, but in this position it would take some time to admit steam enough to move the engine. He further states that when he turned the engine in over the inspection pit, he reported on his work report the defective throttle latch. He further states the reverse lever handled nicely.

1789 Locomotive Inspector M. L. Griffith, who inspected locomotive 4003 upon its arrival over the pit, reported the throttle latch spring weak. Machinist G. S. Miller made repairs to the latch by renewing the spring.

This accident happened December 21st at 3.00 a.m. Engineer Diller first reported his injuries to Dr. Weaver, company surgeon, December 23rd at 1.30 p.m. The engine-house people were not notified until December 27th. I examined the daily inspection reports for the period from December 11, 1927, to the date of the accident and no defects were found reported having any bearing on the accident. Attached is a report from the assistant road foreman of engines stating that Engineer Diller went home on December 21 without reporting the accident and on the same day was notified that he had been displaced by another engineer having seniority over him. On December 23 he called the road foreman's office and asked whether he could displace anyone in the Baltimore yard and was told that he could not but had to go on the extra list. Later that day he called the company surgeon and complained about the injury. The time which elapsed before a report of the injury was made was due to the failure of Engineer Diller to report the matter to the company.

Locomotive 4003 was not held out of service for my inspection. After repairs had been made to the throttle latch in question on the date of accident, the latch and quadrant was later removed and held for my inspection. Upon my arrival January 11th, 1928, I had same assembled and found no defects of any nature concerning throttle lever mechanism. The reversing lever operated perfectly as well as the air-operated cylinder cocks. Locomotive 4003 was equipped with the Stephenson valve motion and D slide valve.

In my opinion this accident was caused by the Engineer hurriedly forcing the reverse lever from neutral to forward gear with steam pressure trapped in the steam chest while the engine was standing. A defective throttle lever latch was a contributory defect. According to the report of the company surgeon, Engineer Diller hurt the same portion of his body 18 years ago when he slipped tank while taking water.

1790 File no. 17252

On January 16, 1929, Engineer Hurd was running Erie Locomotive 3033 in back motion at a speed about 15 miles an hour when suddenly the reversing gear screw support raised up violently pulling out two boiler studs of the six that secured it to the boiler. Water and steam escaped through the stud holes and forced the occupants out of the cab, Engineer Hurd getting out of the left cab window followed by Fireman Obenour and Brakeman Leatherman who went out the left front cab door. All three were scalded and received first degree burns. Engineer Hurd also sustained a bruised back. The accident resulted in a probable disability of two to four weeks for these men. Engineer Hurd stated that the screw reverse gear suddenly heaved up, pulling out two boiler studs, filling the cab with steam and water and that he and the other employees left the cab as above set forth; that he was slightly scalded about the face and his back was injured from jumping out of the cab; that the locomotive was in good condition and had given him no trouble until the accident occurred; that he noticed nothing out of the way with the locomotive or valve gear except when the engine was working hard there was a movement of the screw reverse gear support on the studs and that he could not account for what took place that would caused the accident.

The locomotive was a 2–8–2 type with Baker valve gear, screw reverse, piston valves, Nathan forced feed lubricator. Inspection of the valve gear disclosed that the taper pin securing the left eccentric crank to the shaft was sheared off leaving the eccentric crank loose on the shaft, the pin being a new pin. The left combination lever was bent ahead approximately 3''; the left gear connection rod twisted and bent, and left eccentric rod bent. There were six boiler studs one inch in diameter to which the reverse screw support
1791 was secured; 2 of these studs pulled out of the sheet, one broke off, one cracked 75%, one cracked 25%, and one bent. Both

the piston valves were removed, the bottom of the right valve was scored and cut, also the left valve but not so pronounced as the right valve. The valves were dry and dusty and showed very little oil; this indicating they were dragging due to lack of lubrication which caused one or both of the valves to suddenly stick. When this occurred it sheared the taper pin in the eccentric crank and at the same time throwing excessive strain on the studs securing the reversing screw support to the boiler.

Front cylinder heads removed and cylinders found good all steam passages in cylinders found free and clean.

A careful inspection of all parts of the Baker valve gear and reversing gear failed to show any mechanical defects in workmanship or maintenance. There were no marks on any of the parts to indicate they had been sticking. All connections and pins were in good condition. Nathan mechanical force feed lubricator tested and found feeding properly.

The daily inspection reports for 20 days prior to the accident disclosed nothing pertinent. The cause of the accident was that the piston valves were dry and stuck due to lack of lubrication, throwing excessive strain on studs securing screw reverse support to the boiler, pulling out two studs.

File no. 15949

On May 5, 1927, Engineer Lawrence was operating Erie locomotive no. 2029 double-heading in freight service. While running at a speed of approximately 35 miles an hour near Burns Hill, N.Y., the engineer with the aid of the fireman attempted to hook up reverse lever. The engineer got in front of lever with his back towards front of cab and pushed back while fireman was pulling on
1792 same. Lever gave way and went down to corner in forward motion, catching engineer's arm between reverse lever and injector pipe, causing a fracture of the right arm at the elbow, resulting in a probable disability of three months. The locomotive was not held for inspection so we could not determine the cause of accident. It appeared that this locomotive had received class repairs and had been stored from 3/12/27 to 5/3/27, and was enroute on its first trip from the shop when this accident occurred. We were informed that the reverse lever worked alright when standing but had a good deal of vibration when running and in view of the fact that this locomotive was equipped with a superheater and piston valves, it is fair to assume that this locomotive was not receiving proper lubrication. Due to the engineer's injury no work report was made out. This accident was caused when reverse lever flew into corner in forward motion while engineer was trying to hook up lever. Memo: This locomotive was not equipped with a power reverse gear and if it had been so equipped, no doubt, this accident would not have happened.

File no. 17171

On December 4, 1928, Engineer Tanner while hooking up B. & M. engine 3611 at a speed of 45 miles per hour, had the reverse lever get away from him in some way and he was forced ahead catching his left leg between the reverse lever and air pipe of automatic brake valve. He continued the trip to Boston and was taken to the hospital having sustained a broken ankle, left leg, resulting in an indefinite disability. Locomotive was held for examination and found that there was not sufficient clearance between the reverse lever and air pipe of automatic brake valve. This clearance measured ¾ of an inch about half way up from the quadrant and it was probably at this point that engineer had his leg against boiler when reverse lever went forward. I tested locomotive under steam and had
1793 right piston valve removed but could not find anything wrong. Valve motion and reversing gear were found to be in good condition. Examined work reports from November 25, to December 4, inclusive, but found nothing pertinent. Accident was caused by engineer's leg being caught between reverse lever and brake pipe. There was not sufficient clearance between reverse lever and air pipe of automatic brake valve.

File no. 17751

On September 24, 1929, Engineer Brown while running at a speed of 45 miles per hour near Richland, N.Y., was in the act of shortening the valve travel by hooking up the reverse lever and in so doing lever was pulled back of the center. It would seem from Engineer Brown's statement he was seated at the time of this operation and finding that the reverse lever was back of the center he raised to his feet and unlatched the reverse lever in an endeavor to place it forward of the center, when he lost control of it and in its movement to the front corner it struck and caught his arm breaking the bones of the right forearm and causing a probable disability of two months. The locomotive was equipped with Walschaeret valve gear and piston valves. The locomotive was held for inspection and upon examination I could find nothing unusual and released it for service. The engineer who brought the locomotive to me stated he had no trouble whatever. Prior to the accident on the same run the engineer and fireman who were in charge of the locomotive for 91 miles and the road fireman who was with them for 28 miles each stated they had observed nothing unusual in the handling of the locomotive. I interviewed Engineer Brown's fireman and his statement corresponds with that of Mr. Brown with the addition that the throttle was closed and it is customary to hook up the locomotive about
1794 center when drifting. He also stated he pulled the reverse lever out of the corner to release Brown's arm which was caught between the reverse lever and air pipes.

Work reports revealed nothing pertinent. The report includes copy of a letter from H. S. Rauch advising that the writer had interviewed Engineer Brown who stated that he was running about 45 miles an hour and just before reaching Richland attempted to bring reverse lever up closer to the center and in so doing drew it past the center. He raised to his feet to bring the lever back, forward of the center, and as same bassed center it got away from him throwing him forward in the cab breaking both bones of his right forearm. This letter states that it is apparent that the accident was due to the method of operating the engine and not to any defect of the reversing gear and that the foreman at the enginehouse states that he made no recommendations in regard to repairs or changes. Attached to the report is a statement of Engineer Gilbert who completed the run on which Engineer Brown was injured stating that he inspected the engine carefully and could find nothing wrong with the reverse gear and that the engine operated O.K. from Richland to Solvay and that he did not have any trouble in handling the reverse gear enroute. This accident was caused by the manner in which the operation was made.

File no. 17418

On April 16, 1929, Engineer Snod'y was operating C. C. C. & St. L. engine 6147 near Milroy, Ind. Approaching Milroy there is a descending grade which requires the application of the train brakes to retard speed through the city. Just as Engineer Snoddy closed the throttle to the drifting point and before he had taken his
1795 hand off the throttle lever the reverse lever became unlatched and went forcibly into full forward position catching Engineer Snoddy's left foot between the lever and the triangular block placed against the boiler back head evidently for a footbrace, breaking both bones in his leg just above the ankle joint. Engineer Snoddy was relieved from duty and the locomotive after being dispatched in regular service was held the following day for inspection. The locomotive was equipped with Walschaert motion and piston valves using a hydrostatic lubricator which was found clean and choke plugs in good condition; the single rib quadrant was clean and in good condition; the three working teeth on the reverse lever latch were badly worn tapered and partly filled with grease and dirt; latch spring in good condition. Work reports for 30 days prior to accident were examined and nothing pertinent found. I personally interviewed the following men: Engineer Snoddy who stated he ran the locomotive on the same run March 30, returning April 1. On March 30 the reverse lever went to the corner twice but he had no trouble on return trip; had no trouble at any time with lubrication, and reverse lever handled very easily; Fireman Kendall who operated engine from Milroy to North Vernon after the accident and had no trouble with reverse lever; Engineer Miller who ran engine from

North Vernon to South Anderson, April 17, and had no trouble. Fireman Olesen who had been firing locomotive for 9 or 10 months on this run and never saw reverse lever jump or even rattle; Fireman Weaver who was firing for Engineer Snoddy on March 30 and stated that reverse lever went into corner twice. Attached to the report are the following statements:

1796 Statement of Fireman Kendall: The first trip I ever made on engine 6147 was on April 16 with Engineer Snoddy. I did not notice him having any trouble with the reverse lever jumping out of the quadrant until it jumped out coming into Milroy. Mr. Snoddy had just started to ease off when the reverse lever jumped out. He brakes the train with throttle partly open. The engine lubricated perfectly on this date and the lever did not jump in the corner after the accident nor on the return trip. Engineer Miller on the return trip did not use anything in the latch as he stated he wanted to see whether the lever would jump out and it did not jump out. The only statement I made was to the Federal inspector and I did not tell him the lever had a habit of jumping to the corner. I told him it was my first trip and the lever only jumped to the corner on this trip. I could not say definitely whether Snoddy had a nut on the latch of the lever at this time between Rushville and Milroy but I noticed at times between Anderson and Rushville that he had the nut over the latch of the reverse lever.

Statement of Fireman Ora Olesen: I have fired engine 6147 about 5 or 6 weeks getting her March 19. I never experienced any trouble with the reverse lever jumping out of the quadrant on this engine that I know of. Around April 1 when I returned from laying off the brakeman told me that the reverse lever had been jumping out of the quadrant. The only trouble I know of with this engine was what the brakeman told me. The extra engineer who had this job when the regular engineer and I were off had placed a large nut on the reverse lever to keep it from jumping out. I don't know if this lever had ever been reported jumping out of the quadrant, all I know is what they told me after I came back to work and

1797 also I saw that a large nut had been placed on the reverse lever latch handled by the extra men who had run the job when the regular engineer and I were both off.

Statement of Engineer Carmody: I ran engine 6147 on April 13 and 15. I had no trouble with the reverse lever jumping out of the quadrant but I saw a big nut hanging on the cut-out cock and asked Olesen, the fireman, what it was and he told me they put it in the ratchet as the lever had a habit of going to the corner. Going between stations I would put it in the ratchet just as a preventative but I could notice no jerking on the engine and knew of nothing that would cause the lever to jump out. I did not report this on my work report.

Statement of Engineer Buford: I had engine 6147 into Anderson March 20. At no time did the lever jump nor did I have any trouble with it on this round-trip; nor did I have any trouble with the engine lubricating. I used throttle fully only when it was needed and hooked up the engine where it would work to handle the train best.

Statement of Engineer Miller: I ran engine 6147 April 17 into Anderson. I had no trouble with the reverse lever jumping out of the quadrant from North Vernon into Anderson. On that date there was a nut on the engine and Fireman Kendall told me I had better put it in the reverse lever, that the engine had been jumping out, had jumped out once the day before. I did not use the nut as I wanted to assure myself if there was anything wrong. I ran the engine at an average speed of 35 to 40 miles per hour. It was not necessary to work a wide open throttle. The engine lubricated fine.

Statement of Engineer Hull: I ran engine 6147 into Anderson March 11 and experienced no trouble whatever with the reverse
1798 lever jumping out of the quadrant. I did not have occasion to work a wide open throttle. The engine lubricated all right.

Statement of Engineer Christen: I had engine 6147 into Anderson March 29. I eased engine off at top of Carthage Hill and the lever came out of the quadrant but the cause of it was that someone had spilled oil in the quadrant. I cleaned this out and put sand in and had no further trouble. No defect I could say, just caused by that oil. I did not have occasion to use a wide open throttle and had no trouble with the engine lubricating. I was only going 12 or 14 miles an hour and the lever did not jump out but went down a notch at a time. It did not have enough speed to make it do that. I made no report of this because after cleaning out the oil I examined everything carefully and could see nothing wrong and had no further trouble.

Statement of Engineer Fouts: I remember having engine 6147 for a trip but cannot recall the dates. As far as I can remember I had no trouble whatever with the reverse lever. If I used a wide open throttle it was probably in starting the train but that is all.

Inspectors report gives the following as cause of accident: As this locomotive had been in service from Milroy, Ind., to North Vernon and return to South Anderson, a distance of about 120 miles, it was impossible to determine the condition of the valves and lubrication, hence it was impossible to determine the cause of this accident. As to contributory defects found, all three teeth in the reverse lever latch were badly worn, tapered, and partly filled with grease and dirt. Remarks: From statements of other engineers operating this engine, Engineer Snoddy is the only one that has experienced any trouble with it.

1799 File no. 16788

On May 1928, Engineer Pearce, at Oxford, N.C., reversed S. A. L. locomotive no. 1564 quickly and middle finger of his right hand was caught between the reverse lever and the stud in the boilerhead that holds bracket to which the automatic brake valve is attached, mashing the middle finger of his left hand and causing a disability of 13 days. Examination discloses that there was not sufficient clearance between the handle of reverse lever and boiler back head with reverse lever in forward position, due to stop block missing from quadrant. Work reports for only two days were available and nothing pertinent found. This accident was caused by lack of clearance between the handle of reverse lever and back head of boiler, due to stop block missing. The locomotive was standing at the time of accident.

File no. 15885

On April 15, 1927, Engineer Small was operating M. C. engine 289 near Cumberland Mills, Maine, in passenger service. When moving at a speed of 30 to 35 miles per hour the engine crew noticed a movement of the locomotive which they described as indicating a stuck wedge. This was immediately followed by an unusual noise and the reverse lever being forced violently toward the back end of the quadrant. The reverse lever struck Engineer Small, breaking his left leg above the knee, resulting in indefinite disability and causing multiple fractures at the knee joint. Mr. Small applied the brakes immediately but before the train could be brought to a stop the lever had moved over the quadrant several times in a violent manner with a regularity which he described as corresponding to the ticking of a clock. He was taken in an ambulance to the hospital in Portland and wrecking crew was sent for locomotive.

1800 The main driving axle broke, there being three distinct variations of crystalline structure in the steel which the axle was made of. The reverse lever and latch were in good condition. The reach rod had been bent and the right side tumbling shaft box broken at the time of accident; the right and left main rods and right and left front side rods were bent and the right back side rod broken. The right injector feed water pipe was broken and the right side running board and running board brackets were bent up. The intermittent striking of the broken end of the right rear side rod on the reverse lever occasioned by the revolution of the right rear driving wheel evidently caused the working of the reverse lever over the quadrant between the time of the accident and the time the train was stopped. Work report since April 1, 1927, disclosed nothing pertinent. The cause of the accident was the breaking of the main driving axle. Contributory defects found were an old flaw in the main driving axle covering approximately 60 percent of the cross-sectional area.

File no. 16426

On December 3, 1927, Engineer Howard was operating B. & O. engine 4306 near Concord, Ohio. He stated he noted nothing unusual about the reverse lever quadrant, although the lever went into full motion slowly in drifting into Zanesville and while drifting down grade into New Concord. He thought the drifting brakes were sticking so he reached over to the independent brake valve throwing the handle in full release position to allow any pressure that might be in the brake cylinders to escape, when the reverse lever unlatched coming suddenly to full forward motion (due to quadrant dropping down from the latch by loose bracket connections) catching his hand between the brake valve handle and the top of the reverse lever bruising his left hand and resulting in a probable disability of 10 days. There was about 3/8-inch clearance on this position.

1801 The bolt and bracket securing the quadrant were found loose. There were good notches in the quadrant. The cause of accident was insufficient clearance between the reverse lever bar and the independent brake valve handle in full release position. Contributory defects found were reverse lever latch spring guide stem broken off. Reverse lever bracket for quadrant loose, inside jaw of bracket missing. Rear quadrant stud broken loose in hole, reverse bar bent out of line two inches. Work report for November 25 and December 2, 1927, discloses "Tighten quadrant bracket."

File no. 17459

On May 4, 1929, Engineer Adams was running at 60 miles per hour Wabash engine no. 664 near Blue Mound, Ill., and had attempted to pull the reverse lever back a few notches. The lever jerked away from his grip and caught his left foot between the lever and the boiler back head and badly cut his foot resulting in a probable disabilityy of two months. Investigation disclosed that the manual reverse lever did not have sufficient clearance when in full forward position. At this point the fulcrum of the reverse lever latch came in contact with the air pipe to the fire door and also with the boiler back head, although there was three or more notches clearance around the handle of the lever. Engineer Adams stated that the lever worked down a few notches in the quadrant. He attempted to hook up the lever a couple of notches but instead of the lever coming back it went into the forward corner. In attempting to hook up the lever he had placed his left foot on the boiler head to brace himself and when the lever went into the front corner it caught his foot. Examination disclosed that there was a satisfactory latch spring on the reverse lever. The teeth on the latch in the quadrant were in a fair condition

1802 and satisfactory for service. The locomotive was equipped with a force feed lubricator, and Adams stated that it appeared

to be getting sufficient lubrication and he was unable to account for the accident. The local officials stated that no changes had been made in the reverse gear since the accident but since the locomotive had been in service for about two weeks between the time of accident and this investigation it is impossible to determine what caused the accident. It is very probable, however, that in leaving the terminal at Decatur some water was carried over to the valves and washed off some of the lubrication. The cause of the accident was the reverse lever jerking away from engineer and catching his foot between lever and boiler head. A contributory defect was insufficient clearance around lever.

File no. 16254

On September 7, 1927, Engineer Underwood was reversing Wabash locomotive no. 597 in switching service at Oakwood yard, Detroit, when the counterbalance spring suddenly gave way, causing Engineer Underwood to lose his balance and fall heavily against the throttle lever, injuring the cords and muscles in his neck, resulting in a disability of approximately 17 days. The counterbalance spring was a steel six leaf spring which (each leaf) were ¼ x 3″ in thickness and width; the entire length being 39 inches, held in place by a wrought iron band ½ x 3″ in thickness and width with a lug 3″ in length, with a ¾″ hole for the spring rod to fasten to. The spring was fastened to the waist sheet cross brace support, and the view is unobscured to inspection. An examination of the spring band showed an old break and flaw, and in my opinion, had it been given even a casual inspection, it could have been 1803 detected and removed and the accident adverted. Daily work reports for a period of ten days prior to accident disclosed nothing pertinent. Cause of accident was reversing gear counterbalance spring broke while changing motion with hand reverse lever.

File no. 18166

On June 1, 1930, Engineer Garmon, while running with St. L. S. F. engine no. 1111 in passenger service, near Amber, Okla., at a speed of 40 miles per hour, undertook to lower the reverse lever, but lever got from his control and went into full forward position striking against pipe on boiler and crushing end of the middle finger on his left hand and breaking the bone, resulting in a probable disability of 10 days.

Investigation of locomotive shows that pin in the forward end of the quadrant had lost out, allowing the reverse lever to go within ⅜″ of sander pipe on boiler head. I suggest that the pin be welded to the quadrant and sander valves be rearranged so that full clearance will be given between end of reverse lever and jacket on boiler head. Work reports for the past month disclosed nothing pertinent.

The cause of the accident was insufficient space between end of reverse lever and boiler head after pin placed in quadrant to control forward motion of reverse lever had been lost.

The following is quoted from Engineer Garmon's written statement, made June 3, 1930: "My injury is result of stop pin missing in forward end of reverse quadrant. Had run engine three trips, though did not notice if the stop pin was in quadrant at any time while engine was in my charge. The reverse quadrant is partly encased and rather difficult to see the stop pin, particularly at night. I have not reported the pin missing.

Another thing contributing to the reverse lever going to full forward gear was unusual amount of oil on quadrant and latch.

I had been off a couple of trips, and the other engineer had put too much oil on it. However, I did not notice this until after the accident.

I did not come to a stop at point of accident, though proceeded on to Chickasha, a distance of 5 miles, and called for medical attention, and was delayed 20″ going to the hospital to have my wounded finger dressed. Continued on my run to Quanah, Texas, arriving on time. Asked to be relieved at Quanah, account of my injury.

File no. 16708

On April 20, 1928, Engineer Lowe was operating N. Y. C. & St. L. locomotive no. 383, near Dillon, Ind., in a pick-up movement, running about 20 to 25 miles per hour. Engineer Loew has no recollection of events just prior to the accident, but Fireman Hull states that he noticed Engineer Lowe standing up with his hands on the reverse lever as if he was going to hook reverse lever nearer the center; then the next thing he saw was Engineer Lowe being thrown forward against the boiler back head, then backward against
1804 the coal gates where he laid unconscious, with the broken reverse lever beside him.

Hull closed the throttle and applied the brakes, then as there was no conductor or flagman with them, he went to the interlocking tower at Dillon for assistance. When he returned Lowe had regained consciousness but was unable to move on account of his injuries.

Engineer Lowe sustained a fracture of both bones of the right arm below the elbow, fracture of the left arm above the elbow, bones *bones* of the left leg broken above ankle, cuts on right side of head and right knee resulting in indefinite disability.

Engineer Lowe states he had this locomotive into Michigan City the previous trip and the lubricator was functioning properly then as well as on this trip.

Description of reverse lever lock and quadrant: Located at left of engineer. Quadrant of double-rib type with thirty-eight teeth $\frac{1}{16}$″ tapering to $\frac{5}{16}$″ at top. Reverse lever lock double lock type with 6 teeth forward and back of lever to correspond. Teeth on both found in good condition.

Type of valve gear: Baker valve gear, piston valve inside admission.

Description of damage to locomotive:

Both eccentric rods bent;

Both gear reach rods bent;

Both gear-connecting levers bent;

Left main rod bent;

Left tumbling-shaft box broken;

Reverse lever broken off 1½" below top of quadrant at
1805 V-shaped blacksmith's weld, 60% of which was defective;

Both back end valve-rod pins broken off;

Back piston valve exhaust snap ring, right side, broken into eighteen pieces and outer wall of valve spider has piece about 7 inches long broken out;

Pieces of valve ring and spider wall found in exhaust cavity.

The back edge of valve bus'ing, which was not champered, plainly indicated marks caused by the valve ring catching, which reversed the gear.

Date of last inspection: April 20, 1928, 12:05 a.m., Michigan City, Indiana.

Written statements: Obtained from none. Engineer Lowe, Fireman Hull, Machinist Chapin, and Helper Venice interviewed.

Work reports: Nothing found on work reports that had any bearing on the accident.

This accident was caused by the reverse lever going into full backward position forcibly, allowing the valve to overtravel and catch the broken exhaust ring on the end of the valve chamber bushing, causing the gear to reverse and throw Engineer Lowe forward and backward with great force, resulting in his injuries. Contributory defects found were 60% defective weld in reverse lever, back exhaust valve ring broken, which caught the end of the valve bushing.

File no. 17150.

On November 23, 1928, Engineer Crumm was operating C., B. & Q. locomotive no. 2830 in passenger service in the St. Joseph train yard at a speed of about 5 miles an hour. Before making a stop for
a railroad crossing, Engineer Crumm attempted to push the
1806 reverse lever in an extreme forward motion. Upon raising the latch the lever came back violently and struck him on the left side of the chest, disabling him for a period of 19 days. Engineer Crumm's report (verified personally by him) states: I was approaching the crossing and reducing speed to make crossing stop, and a short distance before train came to a stop I shut off steam and pushed the reverse lever clear down in forward motion; and while my weight was still on it, it came up with terrific force and struck me in the right breast; it knocked the breath out of me for a few minutes, and the fireman started the train, which I was unable to,

after which I handled the train into the depot. I had considerable trouble lubricating the engine going down on no. 42, and more trouble coming back. I thought probably what caused the lever to come back the way it did was due to the valve ring breaking and catching in the port. The foreman brought the locomotive to the station, where the crew was rel'ased. Inspection of the locomotive disclosed front exhaust ring and head of valve broken. Broken parts and valve pushing was removed and held for Federal inspection. Examination showed valve chamber bus'ing was slightly scored, outside flange of front valve head was broken off, only two pieces of broken valve ring could be found, one being found in the valve chamber and the other in the smoke box.

Company records show valve chamber was rebored October 20, 1928, and new valve rings applied. On November 22, no. 2 steam admission ring was found broken, and both no. 1 and no. 2 rings were applied.

It is the practice of this company at this point to examine valves every trip on arrival of locomotive, and record shows Mechanic Thompson examined valves and stated they were O.K. on November 7, 8, 9, 13, 15, 17, and 22.

1807 This locomotive is used in passenger service between Kansas City, Mo., and Omaha, Nebr., cutting out at St. Joseph, Mo., on south-bound trip.

Inspection and repair reports on file at St. Joseph, Mo., were checked for each trip locomotive arrived in St. Joseph from November 1 to date of accident (Nov. 1, 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 16, 17, 18, 20, and 22) defective conditions reported which have had a bearing on cause of accident:

Nov. 1.—Engineer A. C. Hamilton reported "force-feed lubricator leaking and main valves getting dry."

Nov. 4.—Engineer C. Nelson reported "lubricator leaks bad."

Nov. 7.—Inspector M. S. Lee reported "force-feed lubricator leaking."

Nov. 8.—Inspector M. S. Lee reported "force-feed lubricator leaking."

Nov. 9.—Inspector M. S. Lee reported "examine force-feed lubricator pipes, pipes leaking."

Nov. 10.—Inspector M. S. Lee reported "force-feed lubricator leaking."

Nov. 13.—Engineer P. D. Nelson reported "mechanical lubricator leaks oil over outside parts."

Nov. 18.—Inspector M. S. Lee reported "oil leaks at force-feed lubricator."

On November 22, Engineer Crumm arrived at Kansas City, Mo. and reported "engine don't lubricate valves." He also called night roundhouse foreman at St. Joseph, Mo. on phone and asked foreman if there was an engine at that point equipped with a booster to relieve engine 2830 on return trip. He was told there was no

booster passenger engine in St. Joseph but there was
1808 a freight engine type 2–6–2 which would be put on train and this freight engine was at station when engine 2830 arrived.

Engineer Hunt, who relieved Engineer Crumm, handled engine 2830 in picking up additional cars for this train and was of the opinion engine 2830 could continue trip and he took train out of St. Joseph with engine 2830 making up about 40 minutes running time on schedule. Engineer Hunt reported at Omaha "examine valves engine very lame, engine don't lubricate on right side, oil right no. 1 and no. 2 engine truck boxes." Chief Clerk Kerfus to Master Mechanic Wilbur at St. Joseph, Mo., in conversation with Master Mechanic Ford's office at Omaha in connection with this accident was advised cylinder packing right side was found O.K., also lubricator was examined and found working O.K.

Locomotive no. 2830 came into St. Joseph on December 14 where the valve chamber heads were removed and examination showed left valve chamber apparently being insufficiently lubricated. Locomotive was equipped with a Detroit mechanical lubricator. Apparently the primary cause of this accident was insufficient lubrication to valves which was the cause of left valve chamber bushing being scored which in turn caused exhaust ring to break and when Engineer Crumm attempted to push reverse lever in extreme forward motion the broken part of ring caught in port and locomotive moved forward on valve forcing the unlatched reverse lever back violently striking Engineer Crumm on left side of chest.

Accidents of this nature would not occur if locomotives were equipped with power reverse gear.

File no. 17947

On January 4, 1930, Engineer Kinnaird was operating
1809 L. & N. locomotive no. 150 in passenger service. Engineer Kinnaird stated that the reverse lever was rather difficult to handle when he received the locomotive and when a stop was made at Winchester, Ky., he had to take the slack so as to start the train, it was then, in throwing the reverse lever over to backward motion, he was injured, straining his bowels which resulted in an indefinite disability. The engine was standing at the time of accident.

The investigation disclosed that the right valve seat on cylinder and on valve were slightly cut, the left valve yoke was a very snug fit on valve which caused the valve to be hard to move.

Daily inspection reports were examined and the following defects reported which may have a bearing on the accident: January 1, 1930, "Engine steam pipes leaking. Examine exhaust stand for leak." Report approved. January 4, 1930 (after the accident), "Engine handle so hard can't cut back." Report approved. Locomotive no. 150 had come out of the shop on January 1, 1930, having had the following work done: New piston and head; rod bushings

renewed; valve seats on cylinder faced; seats on slide valves faced. Attached to the report is a statement of Engineer Kinnaird disclosing that after the accident he sat down on the seat and supported his lower bowels with his hands and every time I stopped and in cutting engine back the reverse lever worked hard all the way to McRoberts and the fireman helped me continually for the remainder of the trip.

The inspector concludes that in his opinion this accident was caused by water working through the cylinder which cut the right valve and seat on cylinder and the left valve yoke fitting too tight on valve, causing reverse lever to be hard to handle. Contributory defects found were right valve and seat on cylinder slightly cut. Left valve yoke pretty snug fit on valve causing the valve to be rather hard to move.

1810 File no. 16851

On June 28, 1928, Engineer Poole was operating C., R. I. & P. locomotive no. 1402 in local freight service. While running at 15 miles per hour the frong hanger to the right front driving spring broke, the spring fell over on the inside of the fram' of the locomotive, and as one end of spring fell on the ties the upper end of the spring caught under the front end of the right back-up eccentric blade close to link. The spring must have caught in a slanting position under the blade and as the locomotive traveled forward it lifted the blade up, forcing the latch out of the quadrant and throwing the reverse lever back with considerable force, striking Engineer Poole on the left knee and causing injuries that will probably disable him for four and possibly six months. The strain that was put on the third leaf of the driving spring caused the band of the spring to break and bent the leaf considerably out of its proper shape. Work reports examined for four weeks back disclosed nothing pertinent. The reverse lever latch was a good fit in the quadrant and fair fit against reverse lever. The pin at the foot of the reverse lever was in fair condition, being a scant 1/16 inch loose in hole.

File no. 17287

On February 2, 1929, Engineer Walker, while operating C., R. I. & P. locomotive no. 1873 in switching service was moving forward about four miles per hour about 300 feet west of a switch, a jar was felt by the crew and almost immediately the valve gear reverse lever moved back, striking Engineer Walker on his left side below the waiste, causing a hernia with probable disability of two months. The locomotive was stopped. Engineer Walker climbed down and found the right driving wheel spring equalizer stand broken and the driving wheel spring was resting on top of the right valve gear eccentric straps.

1811 After replacing the broken spring equalizer stand the locomotive was continued in service. The locomotive was equipped with manual reverse Stephenson valve gear with D slide valves. Valve seats were well lubricated at the time of investigation and showed no indication of any recent obstruction which might have put an unusual strain on reverse lever. Reverse lever was a single latch tooth type in good condition and latch closed in all positions in quadrant which was anchored firmly to boiler at front end and bracketed to floor at back end. There was no indication of recent repair to any part of reverse gear. There was no indication of excessive fouling by the eccentric blades and straps with any other parts. Work reports for 30 days previous to the accident were checked and nothing pertinent found. Engineer Walker stated that he was running ahead, just coming to a stop, and had arisen from the seat and was turning around preparatory to reversing locomotive, when he felt a jolt such as is caused by spring rigging breaking, and then he was struck on the left side by the reverse lever moving backward. He stated he had made no attempt to unlatch reverse lever and that lever had relatched itself before reaching center of quadrant, having originally been latched about six notches from the front end of quadrant and had moved 7 notches farther back as a result of the accident. This lever had given him no former trouble under normal conditions. The fireman stated he felt the locomotive drop on right side and a quick stop was made. He did not see the lever strike Walker or know of it until both men were on the ground. The machinist stated that he found the locomotive standing with the right no. 3 driving spring right side up free from front hanger but still attached to back hanger and resting diagonally on the two right eccentric cam straps. The engineer's seat on this locomotive was of the side drop type, with its back edge located on line with the back end of the reverse lever quadrant.

1812 Spring was not fouled between eccentric straps on front hangar was on the ground and the equalizer with broken post in it was suspended at front end by back hangar to right no. 2 spring. The reversing gear of this locomotive was in good condition and Engineer Walker had never before had reverse lever to fail to remain latched in normal service. The flaw in the equalizing stand post which was partly induced by the blow hole in the casting and by abnormal strain at that point due to contact of back bottom side of equalizer slot with edge of post, contributed to the failure of the stand and dropping of spring on eccentric straps. The dropping of the spring on the eccentric straps probably placed an undue but apparently not excessive strain against reverse lever latch and if at that time Engineer Walker had involuntarily gripped the reverse lever latch handle and released same the lever might have relatched itself after passing over a few of the notches in the quadrant.

Contributory defects found: Blow hole surrounded by flaw in spring equalizer stand between right #2 and #3 driving wheels; and indication of former contact of back bottom side of equalizer bar slot with stand post.

File 17271

On January 26, 1929, Engineer Young was operating G.N. locomotive no. 905 at a speed of about 30 miles per hour near Stonehill, Mont., when the left front valve strap fouled on a plug which had worked out of the pressure plate and broke the rocker box, the valve yoke, and threw reverse lever backward so as to severely bruise the engineer's left knee, causing a disability of six weeks. Investigation of the mechanical parts reveals that all four of the left pressure-plate stud holes had been drilled entirely through the plate and in order to cover up this faulty drilling, brass plugs had been screwed from the face of the plate into the unused portion of the stud holes,
1813 then brazed over and planed to conform to the face of the pressure plate. The left front outside plug worked out and fouled the valve strap and was the direct cause of the accident. Similar plugs were also used in the right pressure plate.

Work reports do not indicate any previous trouble with the valves fouling on these plugs. New and proper pressure plates were applied to both sides.

Exhibit 13

Complainants' exhibit no. 13 consists of nine pages of index sheets and 231 copies of reports of railway accidents made to the Bureau of Statistics of the Interstate Commerce Commission on form T, pursuant to the requirements of the accident report act (36 Stat.L. 350; U.S. Code, title 45 sec. 38), being different reports made by the carriers of accidents suffered by engineers from operating the reverse lever. The parties agree that this number comprises all of the accident reports received from the Bureau of Statistics during the calendar years 1929 and 1930 and filed under the Bureau's classification "Reverse gear, operating." Mr. McLaughlin further stated that in connection with these exhibits complainants have requested counsel for the carriers to supply the record with the facts as to whether the particular locomotives involved in the report were equipped at the time of accident with manually operated reverse or power reverse. Examiner Rogers directed the carriers to furnish a list covering the accidents in said exhibit showing whether the locomotives at the time of the accident were equipped with hand or power reverse gears.

NOTE.—The reports included in exhibit 13 are all made on the form T which contains the following items numbered as shown:

1813a Name of reporting carrier (1).
Place of accident: Name of State (9). Nearest station (10).
Cause (briefly) (17).
Kind of train (18).

(21) Whether stopped, or moving, and if so, miles per hour.
(24) Details of casualties to persons:
Name and address of person (a).
Class of person (b).
Nature and extent of injuries (c).
Days disability (if killed, so state): Actual (d). Probable (e).
(26) Detail of cause, nature, and circumstances of accident; responsibility and experience of employees responsible; estimate and description of damage to railway property. (With regard to collisions involving any question of train orders, it should be stated whether orders were issued on "form 19" or "form 31."
(In the following narrative the numbers in parentheses refer to the items on this form as above indicated.)

1814

Sheet 12

1. Atchison, Topeka & Santa Fe Ry. Co.
9. California. 10. Wilmington.
17. Strained left side reversing the engine.
18. Extra freight moving 5 miles per hour.
24. (a) G. C. Stevenson, Huntington Park, Calif. (b) A–143, engineer, local road freight. (c) Strained left side. (d) 12 days actual disability.
26. Extra west was switching in the Wilmington yards at the time of the accident, and the engineer strained his left side working the reverse lever. There was no defect in equipment and no rough handling of cars; accident probably caused by the position engineer was in when he tried to operate the reverse lever, causing a strain on his left side.

Sheet 3

1. Atlanta Joint Terminals.
9. Georgia. 10 Atlanta.
17. Reversing engine at roundhouse and struck elbow against cab of engine.
18. Yard engine, standing.
24. (a) W. T. Thompson, Atlanta, Ga. (b) A–144. (c) Contusion over olecranon process of right arm followed by infection and abscess of soft parts. (d) 21 days actual disability.
26. Engineer W. T. Thompson was preparing to move his engine from roundhouse, and, in reversing it, struck his elbow against cab of engine. No defect in equipment. He paid no attention to injury at the time, and his arm became infected before he went to the doctor, four days later.

Sheet 33

1. Baltimore & Ohio Railroad Co.
9. Pennsylvania. 10. Wittmer.
17. While reversing engine hit elbow against cab, injuring wrist.
18. Freight switcher, stopped.
24. (a) E. W. Luke, Pittsburgh, Pa. (b) Rd. frt. engr., 142–A. (c) Left elbow and wrist sprained and bruised. (e) 14 days probable disability.
26. While in act of reversing engine 2200, pulled the reverse lever in reverse position rather quickly, and, in so doing, his left elbow struck back of the cab, causing it to be jammed against handle of reverse bar, causing sprain and bruises of elbow and wrist. Nothing defective about reverse lever.

1815 Sheet 42

1. Baltimore & Ohio R.R. Co.
9. Ohio. 10. Lake Junction.
17. Reversing engine.
18. Local freight, standing.
24. (a) H. R. Keister, Lorain, Ohio. (b) Rd. frt. engr. 143–A. (c) Contusion left chest. (d) 7 days actual disability.
26. Engineer claims was reversing engine from forward to back motion and threw the weight of his body against the bar in doing so, thus causing a contusion of his chest. An examination of engine developed no defects or no condition that would cause the engine to be difficult of handling.

Sheet 85

1. Baltimore & Ohio R.R. Co.
9. Indiana. 10. Mitchell (yard).
17. Operating reverse lever, struck elbow on corner of cab.
18. Freight yard, standing.
24. (a) Chas. T. Cochrum, Seymour, Ind. (b) Yd. fireman, class 148–A. (c) Left elbow badly bruised. (e) 40 days probable disability.
26. Engineer G. L. Heller and Fireman C. T. Cochrum were in charge of engine 2827, switching in Mitchell yard. Fireman Cochrum who was handling engine started to pull reverse lever in backward motion when his left hand slipped off reverse lever and struck left elbow in corner of cab. Elbow did not pain any until one hour and half later when he mentioned it to the engineer, and about an hour later had to be relieved. Reported to Company Dr. Sherwood at Mitchell, returned to Seymour next morning and reported to Dr. Graessle, who advised him that he would be unable to resume duty for possibly 6 weeks. No defect on engine.

Sheet 90

1. Baltimore & Ohio R.R. Co.
9. West Virginia. 10. Charleston.
17. Throwing reverse bar to reverse motion of engine 2943.
18. Freight extra, reversing engine.
24. (a) M. A. Henderson, Gassaway, W.Va. (b) Road frt. engineer, 143–A. (c) Muscles in back badly sprained. (e) 30 days probable disability.

1816 26. Jan. 29, 1929, extra north engine 2943 (no helpers) with train of 18 loads and 20 empties, 1,930 tons, in charge of Henderson, engr.; J. C. McTheny, conductor, and two brakemen, while starting train at Dundon, W.Va. Henderson, engr., attempted to throw reverse bar of locomotive to take up slack in train and when so doing, sprained the muscles in his back account of reverse bar working hard, account of heavy steam in cylinders and when throwing reverse bar back, he turned his body in a twist to the left to get bar back. Engine 2943 in good condition on inspection. Reverse bar latch, quadrant, and deck of engine as well as other parts, found O.K. upon inspection.

Sheet 91

1. Baltimore & Ohio R.R. Co.
9. Ohio. 10. Lore City.
17. Operating reverse gear.
18. Mixed train, standing.
24. (a) C. H. Helsley, Cambridge, Ohio. (b) Rd. frt. engineer, 142–A. (c) Sprained right leg above knee. (d) 24 days actual disability.
26. Engineer had braced himself by placing right foot on straight air pipe to operate reverse lever. In pulling on bar he sprained his leg. There were no defects in reverse gear other than engine was just out of shop and was a little stiff.

Sheet 88

1. Baltimore & Ohio R.R. Co.
9. Maryland. 10. Streckers.
17. Operating reverse lever.
18. Freight extra, standing.
24. (a) H. Hewitt, Keyser, W.Va. (b) Rd. frt. engineer 142–A. (c) Back strained. (d) 7 days actual disability.
26. Engineer H. Hewitt was attempting to operate reverse lever on locomotive equipped with hand reverse; reverse lever worked very stiff due to extreme cold weather, causing engineer to give hard jerk on lever, twisting his back. Nothing defective about reverse lever.

1817 Sheet 69

1. Baltimore & Ohio R.R. Co.
9. Maryland. 10. B. & O. term. Baltimore.
17. Reversing engine, hand slipped and struck thumb on left hand.
18. Freight yard, standing.
24. (a) W. B. Feathers, Baltimore, Md. (b) 144–A, yd. engr. (c) Thumb on left hand contused. (d) 5 days actual disability.
26. While reversing engine left hand slipped resulting in his striking his left hand injuring thumb. Examination of locomotive showed nothing defective. Injury due to proper precaution not being taken by Engr. Feathers.

Sheet 71

1. Baltimore & Ohio R.R. Co.
9. Ohio. 10. Mineral City.
17. Reversing engine, sprained side.
18. Dist. freight extra, standing.
24. (a) Thos. Patterson, Canton, Ohio. (b) Rd. frt. engineer, 143–A. (c) Sprain of left side. (d) 7 days actual disability.
26. In doing local work at Mineral City, Engineer Patterson attempted to reverse engine, and states he exerted too much strength in the effort, straining muscles of left side. There was no defect on engine.

Sheet 72

1. Baltimore & Ohio R.R. Co.
9. Pennsylvania. 10. New Castle Junction (yard).
17. Reversing engine.
18. Freight extra, standing.
24. (a) T. C. Bollard, New Castle, Pa. (b) Rd. frt. engr., 142–A. (c) Strain of right groin and upper right leg. (d) 12 days actual disability.
26. Engine 6169 was new engine just received from shop, and while getting ready for road trip, Engineer Bollard attempting to reverse engine on ready track, the reverse gear worked hard, although no defects later were developed, and engineer exerted so much strength in jerking on reverse gear that it caused a strain of groin and leg.

1818 Sheet 78

1. Baltimore & Ohio R.R.
9. Ohio. 10. Hamilton.
17. Operating reverse lever.
18. Freight 91, at rest.
24. (a) Chas. W. Cox, Indianapolis, Ind. (b) Rd. frt. engineer, 142–A. (c) Strained private parts (traumatic orchitis). (d) 13 days actual disability.

26. Train was standing at Hamilton, Ohio, water spout, Engineer Cox attempted to reverse engine and failed. He placed right foot against steam pipe to right injector above operating valve, as a brace, and threw reverse lever in back motion, felt a sharp pain when he threw reverse lever over. Inspection by mechanical department did not develop any defects to equipment. No trouble was experienced with reverse bar prior or subsequent to injury.

Sheet 81

1. Baltimore & Ohio R.R. Co.
9. West Virginia. 10. Clarksburg.
17. Reversing engine, feet slipped and he fell back.
18. Fd. frt., standing.
24. (a) S. G. Hamilton, Bridgeport, W.Va. (b) Yd. engr., 144–A. (c) Back sprained. (d) 5 days actual disability.
26. While switching cars at Clarksburg yard, Yard Engineer S. G. Hamilton went to reverse engine and, while putting bar back, slipped and fell back, spraining his back. Inspection did not develop anything wrong with equipment.

Sheet 6

1. Bangor & Aroostook R.R. Co.
9. Maine. 10. Phair.
17. Slipped tendons in right shoulder.
18. Mixed train 66, standing.
24. H. K. Donaghy, Fort Fairfield. (b) A–143. (c) Slipped tendon in right shoulder. (d) 17 days actual disability.
26. Reversing engine and wrenched arm, resulting in slipped tendon in right shoulder.

1819

Sheet 10

1. Boston & Albany.
9. Massachusetts. 10. Charlton.
17. Throttle struck engineer's eye.
18. Freight ex. 1433, stopped.
24. (a) J. Gordon, 75 Othello Rd., Worcester, Mass. (b) A–142. (c) Contusion of left eyelid with hemorrhage into conjunctiva of eye. (d) 8 days actual disability.
26. This engineer taking slack in train was reversing engine when throttle flew open, striking him on left eye. Engineer claims throttle was leaky, but upon inspection at enginehouse throttle was found not in a defective condition.

Sheet 58

1. Boston & Maine R.R.
9. Massachusetts. 10. So. Acton.
17. —.

18. Freight B–10—0 miles per hour.
24. (a) James O'Halloran, Charlestown, Mass. (b) A–143. (c) Low back strain. (e) 84 days probable disability.
26. Engineer strained his back while operating reverse lever on engine no. 1425.

Sheet 25

1. Boston & Maine R.R.
9. Massachusetts. 10. Winchester High.
17. Pulling reverse lever.
18. Freight—4 miles per hour.
24. Joseph Shephard, Somerville, Mass. (b) A–143. (c) Contusions of right shoulder, followed with traumatic arthritis. (e) 60 days probable disability.
26. While pushing reverse lever, strained his right side and shoulder.

1820 Sheet 28

1. Boston & Maine R.R.
9. New Hampshire. 10. Tilton.
17. Pulling reverse lever.
18. Passenger train 5—starting.
24. (a) E. H. Maynard, Concord. (b) A–141. (c) Sprained ligaments in left hip. (d) 16 days actual disability.
26. Reverse lever stuck in extreme forward end of reverse lever quadrant; attempting to pull same out Maynard injured his hip.

Sheet 23

1. Boston & Maine R.R.
9. Massachusetts. 10. Marblehead.
17. Wrenched back while using reverse lever.
18. Passenger train 2221—0 m.p.h.
24. (a) Harrison I. Whitney, Danvers, Mass. (b) A–141. (c) Strained muscles of back. (d) 7 days actual disability.
26. Engineer strained back while using reverse lever without first letting steam out of the cylinders.

Sheet 24

1. Boston & Maine R.R.
9. New Hampshire. 10. Woodsville.
17. Engineer claims that reverse lever handled hard.
18. Freight extra—0 m.p.h.
24. (a) C. E. Winslow, Woodsville, N.H. (b) A–143. (c) Strained back. (d) 17 days actual disability.
26. Engineer claims that due to reverse lever handling hard, he strained his back.

1821 Sheet 12

1. Boston & Albany R.R.
9. Massachusetts. 10. West Springfield.
17. Using reverse lever.
18. Passenger, lite eng.—0 m.p.h.
24. (a) Thomas Dagnall, 316 Park St., West Springfield, Mass. (b) A–129. (c) Chest strained. (d) 7 days actual disability.
26. This man employed as hostler, was at the old engine house at West Springfield, and had engine 519, and while using the reverse lever it worked quite hard. While giving it an extra hard pull, he strained his chest.

Sheet 3

1. Buffalo and Susquehanna R.R. Corp.
9. Pennsylvania. 10. B. & S. Jct., Pa.
17. —.
18. Mixed train 31—standing.
24. (a) D. J. Heath, Dubois, Pa. (b) Engineer A–143. (c) Slight fracture short rib left side. (d) 12 days actual disability.
26. Standing on reverse lever to close globe valve, slipped off striking side on throttle causing slight fracture of short rib, left side.

Sheet 3

1. Burlington-Rock Island Co.
9. Texas. 10. Dobbin.
17. Foot slipped off release lever.
18. Freight ex. 32—15 miles per hour.
24. (a) P. F. Warren, Teague, Texas. (b) A–142. (c) Left side and leg bruised. (e) 30 days probable disability.
26. While operating reverse lever, foot slipped throwing him against lever and bruising his side and leg.

1822 Sheet 13

1. Chicago, Burlington & Quincy R.R. Co.
9. Nebraska. 10. Alliance.
17. Pulling on reverse lever.
18. Switch train—still.
24. (a) J. J. Rogers, Alliance, Nebr. (b) A–144 yrd. engr. (c) Dislocated vertebra in spine. (e) 10 days probable disability.
26. While reversing reverse lever strained back in pulling on lever.

Sheet 12

1. Chicago, Burlington & Quincy R.R.
9. Missouri. 10. Kansas City.
17. Improper handling of throttle.

18. Switch train—still.
24. W. F. Farrer, Kansas City, Kans. (b) A–44 yard engr. (c) Strained right side. (e) 4 days probable disability.
26. Had engine 1432 about 2 a.m. Feb. 12, 1930, switching in K.C. yards. He shoved throttle in, not knowing throttle had eased open a little, letting steam in cylinder. In reversing engine he found it hard to reverse and not expecting it, he strained right side.

Sheet 19

1. Chicago, Burlington & Quincy R.R. Co.
9. Illinois. 10. Neponset.
17. Took hold of reverse lever to pull back.
18. Passenger train 1—50 miles per hour.
24. E. F. McNally, Galesburg, Ill. (b) A–141, rd. pass. engr. (c) Strained left elbow. (e) 17 days probable disability.
26. Took hold of reverse lever to pull back, something snapped in elbow.

1823 Sheet 25

1. Chicago, Burlington & Quincy R.R.
9. Nebraska. 10. Red Cloud.
17. Struck arm against blow-off valve lever.
18. Frt. ex. 5004—5 miles per hour.
24. (a) John Paul Pangburn, Wymore, Nebr. (b) A–142 rd. frt. engr. (c) Transverse fracture tip oleocranon process right ulna, no displacement of fragments. (d) 38 days actual disability.
26. While switching with engine 5004 in Red Cloud yards, when pulling reverse lever back, struck arm against blow-off valve lever in cab.

Sheet 28

1. Chicago, Burlington & Quincy R.R. Co.
9. Nebraska. 10. Lincoln.
17. Reversing engine.
18. Freight—still.
24. (a) R. E. Manfield, Lincoln, Nebr. (b) A–142, rd. engr. (freight). (c) Strained tendon, back of left leg. (e) 14 days probable disability.
26. While trying to reverse engine from backward to forward motion, strained tendon in back of left leg.

Sheet 31

1. Chicago, Burlington & Quincy R.R. Co.
9. Illinois. 10. Congress Park.
17. Trying to pull back reverse lever.
18. Passenger train 120—30 miles per hour.

24. (a) G. H. Miller, Downers Grove, Ill. (b) A–141, engineer (rd. pass.). (c) Left side of back bruised or strained. (e) 10 days' probable disability.
26. Was trying to pull back reverse lever; hurt back.

1824 Sheet 34

1. Chicago, Burlington & Quincy R.R. Co.
9. Nebraska. 10. Ferry.
17. Throwing reverse lever.
18. Ex. frt. 3107—still.
24. (a) C. D. Shaw, Ferry, Nebr. (b) A–143, rd. frt. engineer (local and way frt.). (c) Sprained back. (d) 14 days actual disability.
26. Was throwing reverse lever on engine and sprained back.

Sheet 97

1. Chicago, Burlington & Quincy R.R. Co.
9. Wisconsin. 10. Crawford.
17. Helping engineer throw reverse lever over.
18. Passenger train 47—2 miles per hour.
24. (a) F. A. Maas, LaCrosse, Wis. (b) A–145, rd. pass. fireman. (c) Strained back. (e) 7 days probable disability.
26. Was helping engineer throw reverse lever over which would not move account snow and ice.

Sheet 23

1. Chicago, Burlington & Quincy R.R. Co.
9. Wisconsin. 10. East Winona.
17. Adjusting reverse lever while train was in motion.
18. Passenger train 58—45 miles per hour.
24. (a) Fred Stallsmith, LaCrosse, Wis. (b) A–141, rd. pass. engr. (c) Right forearm strained and right elbow bruised. (d) 9 days actual disability.
26. When adjusting reverse lever while train was in motion, caught his arm between lever and front wall of cab with lever between thumb and front finger.

1825 Sheet 26

1. Chicago & North Western Ry. Co.
9. Wisconsin. 10. Hortonville, main line.
17. Reverse lever jerked out of his hand.
18. Passenger train 141—35 miles per hour.
24. (a) John Moliter, 51, Antigo, Wis. (b) A–141, rd. pass. engr. (c) Incomplete fracture of shafts of 2nd and 3rd metatarsal bones, left. (d) 30 days actual disability.

26. Injured man was letting reverse lever down on engine 422 when the lever jerked out of his hands account of valves being dry and caught his foot, which had slipped off boiler head, between lever and train line pipe. Engine was inspection and found to be in good condition.

Sheet 25

1. Chicago and Northwestern Ry. Co.
9. Illinois. 10. Garden Prairie.
17. Reverse lever jerked out of hands.
18. Passenger extra—50 miles per hour.
24. (a) D. A. Moseley, 43, Chicago, Ill. (b) A–141, road pass. engineer. (c) Potts fracture of lower end of fibula. (e) 90 days probable disability.
26. While attempting to hook up engine 1396 reverse was jerked to forward end of quadrant, catching injured man's foot between the lever and an air pipe on back of boiler. Engine was inspected and found to be in good condition with no defects.

Sheet 18

1. Chicago and North Western Ry. Co.
9. Minnesota. 10 Fairmont.
17. Failed to set independent brake on engine.
18. Thru frt. 223—still.
24. (a) H. E. Blowers, 61, Mason City, Iowa. (b) A–142, rd. frt. engr. (c) Amputation of 4 toes, left foot. (d) Permanent disability.
26. Injured man failed to set independent brake on engine before instructing fireman to move reverse lever and his left foot was caught between eccentric arm and crank arm when engine moved forward. It is supposed there was sufficient spring in the draw bars of the train and engine, when the reverse lever was thrown in full forward position, together with the steam in the superheater units and cylinders, to move the engine a short distance. Engine inspected and found to be in good condition.

1826 Sheet 25

1. Chicago & North Western Ry. Co.
9. Wisconsin. 10. South Milwaukee.
17. Reverse lever went into corner and caught foot.
18. Passenger train—40 miles per hour.
24. (a) F. R. Alcock, 45, Kenosha, Wis. (b) A–141, rd. pass. engr. (c) Contusion of right foot; fracture of right great toe. (e) 21 days probable disability.
26. Injured man intended to drop the reverse lever a notch and it slipped out of his hands and went into the corner catching his foot. Engine was inspected and found to be in good condition.

Sheet 30

1. Chicago & North Western Ry. Co.
9. Wisconsin. 10. Ripon, main.
17. Reversing engine.
18. Local freight 38—standing.
24. (a) L. M. Gosselin, 56, Fond du Lac, Wis. (b) A–143, rd. frt. engr. (c) Strain of muscles over right side of abdomen. (d) 4 days actual disability.
26. Injured man's foot slipped off step at quadrant when pushing reverse lever ahead, straining ligaments in abdomen and side. Engine was inspected and found to be in good condition.

1827 Sheet 34

1. Chicago and North Western Ry. Co.
9. Minnesota. 10. Plainview, main.
17. Reversing engine.
18. Wrecker.
24. (a) H. A. Tews, 43, Waseca, Minn. (b) A–143, rd. frt. engr. (c) Sprain of sacro illiac articulation and right hip. (d) 10 days actual disability.
26. Injured man was operating engine 1139 in rerailing engine and snowplow and strained his back.

Sheet 47

1. Chicago and North Western Ry. Co.
9. Wisconsin. 10. Wiscona, main.
17. Reversing engine.
18. Passenger—moving 25 miles per hour.
24. (a) Wm. H. Stringer, 39, Milwaukee, Wis. (b) A–141, rd. pass. engr. (c) Contusion of toes of left foot. (d) 7 days actual disability.
26. Injured man was trying to hook up engine 29 and reverse lever got away from him and went into the corner and caught his foot which he had placed against boiler to brace himself. Engine was inspected and found to be in good mechanical condition but had been stored serviceable for 2 months, causing it to work a little hard.

Sheet 50

Chicago and North Western Ry. Co.
9. Illinois. 10. Chicago, yard.
17. Reversing engine.
18. —. 19. Switch 1198, standing.
24. (a) Jerry Hanley, 60, Chicago, Ill. (b) A–144, yd. engr. (c) Complains of pain in right shoulder. (d) 13 days actual disability.

26. Injured man claims that he strained his right shoulder while attempting to reverse engine. Fireman working with this man knows nothing about injury. Engine was in good mechanical condition.

1828 Sheet 52

1. Chicago and North Western Ry. Co.
9. Wisconsin. 10. Kenosha, yard.
17. Helping engineer to reverse engine.
18. Passenger, standing.
24. (a) G. C. McDaniel, 31, Chicago, Ill. (b) A–145 rd. pass. fireman. (c) Strain of back. (d) 9 days actual disability.
26. Injured man was helping engineer reverse engine and strained his back. Engine inspected and found to be in good condition and it was decided that lever threw over hard account of extreme cold weather and frost on valve gear parts.

Sheet 54

1. Chicago and North Western Ry. Co.
9. Illinois. 10. Algonquin, main.
17. Operating reverse lever for engineer.
18. Passenger, still.
24. (a) Joseph W. Horn, 32, Chicago, Ill. (b) A–145, rd. pass. fireman. (c) Laceration on bridge of nose. (d) 6 days actual disability.
26. Train no. 755 was stuck in the snow and injured man was helping engineer to reverse engine when the throttle flew open and struck him on the nose. Engine was inspected and found to be in good working and mechanical condition.

Sheet 8

1. Chicago, St. Paul, Minneapolis & Omaha Ry. Co.
9. Wisconsin. 10. Humbird.
17. Reverse lever operating.
18. Passenger, moving 60 miles per hour.
24. (a) F. W. Koppen, Altoona, Wis. (b) A–141, road pass, engineer. (c) Hernia, right side. (e) 60 days probable disability.
26. Injured self while hooking up reverse lever on engine. Locomotive parts or appurtenances were not defective.

1829 Sheet 5

1. Chicago, St. Paul, Minneapolis & Omaha Ry. Co.
9. Wisconsin. 10. Chili.
17. Reverse lever, operating.
18. Freight, moving 20 miles per hour.
24. (a) J. P. O'Connell, Marshfield, Wis. (b) A–143, road frt. engineer (way frt.). (c) Bruised left foot. (e) 30 days' probable disability.

26. He got his foot caught between reverse lever and boiler head on locomotive while changing the position of lever. Locomotive parts or appurtenances were not defective.

Sheet 12

1. Chicago, St. Paul, Minneapolis & Omaha Ry. Co.
9. Iowa. 10. Hospers.
17. Reverse lever, operating.
18. Passenger, just starting.
24. Ed. Fagerman. (b) A–141, rd. pass. engr. (c) Bruised shin bone on right leg. (d) 12 days actual disability.
26. Reversing engine to take slack in train, foot slipped while pulling or pushing on reverse lever, right leg striking reverse-lever latch. Inspection made of locomotive showed reverse lever in good working order and not defective.

Sheet 14

1. Chicago, St. Paul, Minneapolis & Omaha Ry. Co.
9. Wisconsin. 10. Rodell.
17. Reverse lever, operating.
18. Passenger, moving 40 miles per hour.
24. (a) L. M. Page, Eau Claire, Wis. (b) A–141, rd. pass. engineer. (c) Bone broken in large toe, right foot. (e) 60 days probable disability.
26. He was hooking reverse lever up on locomotive when same pulled down to full forward position, catching his foot. The inside arm to reach rod carrier was broken off and missing; roller and bolt which retains roller in reach rod guide was missing. Defective parts were repaired and replaced.

1830

Sheet 7

1. Chicago, St. Paul, Minneapolis & Omaha Ry. Co.
9. Wisconsin. 10. Elroy.
17. Reverse lever, operating.
18. Yard service, standing.
24. (a) P. A. McLain. (b) A–144, yd. engineer. (c) Sprained cords in left hand. (d) 12 days actual disability.
26. He was operating reverse lever on locomotive and while placing same in backward motion he struck his elbow against the back board. Locomotive parts or appurtenances were not defective.

Sheet 34

1. Chicago, Rock Island and Pacific Ry. Co.
9. Iowa. 10. Seymour.
17. Slipped while reversing engine.
18. Local freight, moving five miles per hour.

24. (a) A. D. Stiles, Trenton, Mo. (b) A–143, r.f. engineer. (c) Right side strained. (d) 12 days actual disability.

26. Engineer was reversing engine and his foot slipped, causing him to strain himself.

Sheet 19

1. Chicago, Rock Island and Pacific Co.
9. Iowa. 10. West Chester.
17. Struck by reverse lever.
18. Mixed train, moving 5 miles per hour.
24. (a) D. D. Morrissey, Oskaloosa, Iowa. (b) A–142, r.f. engineer. (c) Side bruised. (d) 15 days actual disability.
26. While switching, as engineer pulled throttle out, reverse lever came down, striking him, as he was looking back for signal.

1831 Sheet 22

1. Chicago, Rock Island and Pacific Ry. Co.
9. Iowa. 10. Oskaloosa.
17. Slipped when reversing engine.
18. Yard, standing.
24. (a) F. F. Whalen, Oskaloosa, Iowa. (b) A–144, yd. engineer. (c) Right groin strained. (d) 10 days actual disability.
26. Engneer was reversing engine and slipped and fell backward against backboard of engine. Nothing defective about equipment.

Sheet 14

1. Chicago, Rock Island and Pacific Ry. Co.
9. Iowa. 10. Winslow, near.
17. Struck against end of throttle.
18. Freight train moving 30 miles per hour.
24. (a) C. J. Brown, Des Moines, Iowa. (b) A–143, R.F. engineer. (c) Left side bruised. (d) 8 days actual disability.
26. Engneer was running engine and took hold of reverse lever, and it slipped out of his hand and he struck against end of throttle. Nothing defective about equipment.

Sheet 44

1. Chicago, Rock Island & Pacific Ry. Co.
9. Illinois. 10. Blue Island.
17. —
18. —
24. (a) O. Stoneking, Blue Island. (b) A–147, R.F., fireman. (c) Infected bruise right thumb. (d) 31 days actual disability.
26. Fireman was assisting in reversing engine and bumped his thumb on reverse lever.

1832 Sheet 45

1. Chicago, Rock Island & Pacific Ry. Co.
9. Illinois. 10. Chicago.
17. Strained self reversing engine.
18. Passenger train moving 2 miles per hour.
24. (a) F. Vinicky, Chicago, Ill. (b) A–145, R.P., fireman. (c) Abdomen strained. (d) 12 days actual disability.
26. Fireman was assisting engineer in reversing engine and he strained himself.

Sheet 22

1. Chicago, Rock Island & Pacific Ry. Co.
9. Illinois. 10. Seneca.
17. Strained self reversing engine.
24. (a) C. Gloyd, Seneca, Ill. (b) A–144, R.F., engineer. (c) Muscles of back and arms strained. (d) 13 days actual disability.
26. Engineer was reversing engine and strained himself.

Sheet 28

1. Chicago, Rock Island & Pacific Ry. Co.
9. Illinois. 10. Chicago.
17. Caught thumb in back curtain.
18. Passenger train.
24. (a) W. Humphrey, Chicago, Ill. (b) A–145, R.P., fireman. (c) Thumb dislocated. (d) 4 days actual disability.
26. Fireman was throwing reverse lever and caught his thumb in back curtain. Nothing defective about equipment.

1833 Sheet 17

1. Chicago, Rock Island & Pacific Ry. Co.
9. Illinois. 10. Joliet.
17. Sprained back reversing engine.
18. Yard train, standing.
24. (a) C. A. Travis, Blue Island, Ill. (b) A–144, yd. engineer. (c) Back sprained. (d) 6 days actual disability.
26. Engineer was reversing engine and sprained his back.

Sheet 24

1. Chicago, Rock Island & Pacific Ry. Co.
9. Oklahoma. 10. Geary.
17. —.
18. —.
24. (a) J. L. Rutty, Shawnee, Okla. (b) A–141, R.P. engineer. (c) Left wrist sprained. (d) 24 days actual disability.

26. Engineer was reversing engine and sprained his wrist. Nothing defective about equipment.

Sheet 30

1. Chicago, Rock Island & Pacific Ry. Co.
9. Oklahoma. 10. Enid.
17. Foot caught between lever and quadrant support.
18. Yard train moving six miles per hour.
24. (a) O. P. Morrell, El Reno, Okla. (b) A–144, yd. engineer. (c) Left foot bruised, little toe broken. (d) Five days actual disability.
26. Engineer was running engine, switching cars, and when he threw reverse lever back his foot was caught between lever and quadrant support account of him placing his foot on running board at back end of quadrant just ahead of quadrant support. Nothing defective about equipment.

1834 Sheet 30

1. Chicago, Rock Island & Pacific Ry. Co.
9. Iowa. 10. Valley Jct. (yd.).
17. Sprained back reversing engine.
18. Yard.
24. (a) J. Jensen, Valley Junction, Iowa. (b) A–144, yd. engineer. (c) Back sprained. (d) 15 days actual disability.
26. Engineer was putting reverse lever into reverse position on engine and sprained his back.

Sheet 25

1. Chicago, Rock Island & Pacific Ry. Co.
9. Kansas. 10. Goodland Sta.
17. Foot slipped.
18. Passenger, standing.
24. (a) J. A. beals, Denver, Colo. (b) A–145, R.P. fireman. (c) Back sprained. (d) 14 days actual disability.
26. Fireman was assisting engineer in reversing engine when his foot slipped and he strained his back. Nothing defective about equipment.

Sheet 29

1. Chicago, Rock Island & Pacific Ry. Co.
9. Oklahoma. 10. Apache.
17. Toes caught reversing engine.
18. Work extra, standing.
24. (a) J. J. Rawlins, El Reno, Okla. (b) A–143, R.F. engineer. (c) Toes bruised and infected. (d) 14 days actual disability.
26. Engineer was reversing engine and got his foot caught between reverse lever and floor of cab.

1835 Sheet 5

1. Chicago Great Western R.R. Co.
9. Iowa. 10. Halbur.
17. Reverse lever slipped from hands and struck foot.
18. Freight 1st 71 moving 20 miles per hour.
24. (a) W. D. Rohrback, engineer, Clarion, Iowa. (b) A–142. (c) Fracture small bone in ankle. (e) 40 days probable disability.
26. Engineer attempted to move reverse lever up a notch bracing his foot against gauge cock drain pipe. The lever slipped from his hand and went forward. At the same time his foot slipped off the pipe and was struck by reverse lever. No defects in equipment.

Sheet 17

1. Chicago Great Western R.R. Co.
9. Minnesota. 10. Rochester.
17. Thrown against reverse lever of engine account impact caused by switching.
18. Extra freight moving 10 miles per hour.
24. (a) George Williams, Red Wing, Minn. (b) A–142. (c) Lower left abdomen injured. (e) 30 days probable disability.
26. After stopping train and cutting off engine to do some switching, the engine and 3 cars were moving toward train for the purpose of pulling it in to the clear, when the cars being moved by engine struck train with sufficient force to throw Engineer Williams against the brake lever causing his injury. The brakeman and engineer were jointly responsible for the accident.

Sheet 5

1. Chicago and Western Ind. R.R. Co.
9. Illinois. 10. Chicago.
17. Handling reverse lever.
18. Yard service moving 6 miles per hour.
24. (a) E. L. Twoxell, 642 W. 64th St. (b) Engr., A–144. (c) Strain to muscles of right groin. (d) 20 days actual disability.
26. Emergency brakes were set and would not release. He was moving reverse lever back and forth against steam and while doing so strained his right groin.

1836 Sheet 4

1. Chicago and Western Ind. R.R. Co.
9. Illinois. 10. Chicago.
17. Struck hand against boiler head.
18. Yard service, standing.
24. (a) Nick Brandt, 4803 Laflin St. (b) Engineer. (c) Contusion back of left hand with laceration over second knuckle; X-ray negative. (d) 32 days actual disability.

26. He was engineer, engine 215 in coach yard service. When throwing reverse lever in forward position, it jerked him forward and his hand struck boiler head.

Sheet 1

1. Chicago and Western Ind. R.R. Co.
9. Illinois. 10. Chicago.
17. Counterbalanced spring not properly set.
18. Yard service, standing.
24. (a) W. F. Keleher, 8440 Elizabeth St. (b) Yd. engr., A–144. (c) Contusion over back of left wrist. (d) 10 days actual disability.
26. He was the engineer on engine 216 and when he was reversing the engine into backward motion, counterbalanced spring not being properly set, the lever went back and caught his left hand against backboard in cab.

Sheet 13

1. Chicago & Eastern Ill. Ry.
9. Indiana. 10. Howard.
17. Assisting to reverse lever.
18. Extra freight, standing.
24. (a) W. W. Osmon, Evansville, Ind.; road freight fireman. (b) A–146. (c) Sprain of back. (d) Five days actual disab[illegible]
26. While working as a member of crew in charge of Chicag[illegible] Eastern Illinois Railway Company southbound freight train [illegible] by engine no. 1907 detouring over tracks of Penna. R.R. Co. inju[illegible] person claimed he sprained back while assisting to reverse lever [illegible] engine.

1837 Sheet 4

1. Chicago & Eastern Ill. Ry. Co.
9. Indiana. 10. Princeton.
17. Operating reverse lever.
18. Passenger train standing.
24. (a) W. H. Fitch, Evansville, Ind. (b) A–141, road pas[illegible] engineer. (c) Sprain of right side. (d) 15 days actual dis[illegible]
26. While working as a member of crew in charge of northbound passenger train number 94 drawn by engine no. 1010, injured person sprained side while operating reverse lever of engine.

Sheet 3

1. Chi. & E. Illinois Ry. Co.
9. Illinois. 10. Chicago, 14th.
17. Operating reverse lever.

18. Yard.

24. (a) J. W. Sheridan, Chicago Ill. (b) A–144, Yd. Engr. (c) Sprained right hip. (d) 17 days actual disability.

26. While working as a member of crew in charge of yard engine, no. 3639 injured person sprained hip while operating reverse lever of engine.

Sheet 11

1. Chicago and Eastern Illinois Ry. Co.

9. Indiana. 10. Princeton.

17. Operating reverse lever on engine, standing.

24. (a) Gus Kruskemeyer, Evansville, Ind. (b) A–143, rd. ft. engr. (c) Sprain of back. (d) Nine days actual disability.

26. While working as a member of crew in charge of southbound freight train no. 361 drawn by engine no. 929 injured person sprained back while operating reverse lever on engine.

1838

Sheet 5

1. Chicago and Erie R.R.

9. Indiana. 10. Servia.

17. 6316. Bruised finger between reverse lever and backboard of cab.

18. Passenger standing.

24. (a) A. M. Lowman, age 55, Huntington, Ind. (b) A–141. (c) Severely bruised thumb of left hand. (d) Seven days actual disability.

26. Engineer Lowman in reversing engine caught thumb of left hand between reverse lever and backboard of cab, bruising thumb.

Sheet 7

1. Chicago and Alton R.R.

9. Illinois. 10. Ridgely.

17. Claims that he injured his right arm while operating reverse lever on engine.

18. Switch train moving five miles per hour.

24. (a) M. Peifer, Springfield, Ill. (b) A–144, yd. engineer. (c) Blood vessel bursted and ligaments torn loose in right arm. (e) 45 days probable disability.

26. Engineer Peifer claims that while on duty on engine 56 he strained his arm while attempting to operate the reverse lever, and examination later showed that a blood vessel had been ruptured and ligaments torn loose in his right arm. Inspection of engine 56 failed to disclose any defect, but this engine had been recently turned out of shops after being overhauled, and it would appear that the reverse lever operated rather hard.

Sheet 25

1. Chicago, Milwaukee, St. Paul & Pacific R.R. Co.
9. Minnesota. 10. Clear.
17. Hooking up reverse lever, got loose and caught foot between lever and boiler head.
18. Passenger moving 50 miles per hour.
24. (a) Henry Seyfried, Minneapolis, Minn. (b) A–141, pass. engr. (c) Bruised ankle and foot, right. (e) 21 days probable disability.
1839 26. Was attempting to hook up reverse lever with assistance of fireman and lever got away from them and went to forward corner of quadrant catching Engr. Seyfried's foot and leg against boilerhead. The air was set in emergency and train stopped and fireman released him. Badly bruised foot and ankle.

Sheet 44

1. Chicago, Milwaukee, St. Paul & Pacific Ry. Co.
9. Illinois. 10. Elgin.
17. Sprained small of back account reverse lever working hard.
18. Passenger, putting engine in roundhouse.
24. (a) Ervin C. Agness, Chicago, Ill. (b) A–141, pass. engr. (c) Back sprained. (e) 30 days probable disability.
26. Ervin C. Agness, age 39, employed as engineer on the Illinois division, was placing engine in roundhouse at Elgin, Ill., when he suffered a sprain in the small of his back due to lever operating with difficulty. Was attended by Dr. Metz at the Washington Blvd. Hospital.

Sheet 44

1. Chicago, Milwaukee, St. Paul & Pacific R.R. Co.
9. Wisconsin. 10. Milwaukee.
17. Crank pin installed incorrectly.
18. Yard switch train.
24. (a) Edw. Keller, Milwaukee, Wis. (b) A–128, outside hostler. (c) Internal injuries. (e) 30 days probable disability.
26. Backing engine 2769 out of roundhouse, and when he started out, engine began moving in a forward motion. Grabbed hold of reverse lever in order to swing it over. Then the reverse lever caught him in the abdomen, injuring him internally. Investigation developed that the crank pin was not installed properly and this caused engine to move back when in forward motion and vice versa. Mechanics responsible were severely reprimanded.

1840 Sheet 25

1. Cleveland, Cin., Chicago & St. Louis Ry.
9. Indiana. 10. Johnson.
17. Failed to note position of his foot.

18. Extra freight moving 15–20 miles per hour.
24. (a) Harry Hershey, Mt. Carmel, Ill. (b) A–142, rd. frt. engr. (c) Lacerated wound of left leg; contusion of leg muscles; sprain of back. (e) 31 days probable disability.
26. Attempted to pull reverse lever back and, instead, it went forward, catching his left foot between lever and brake pipe. No defects.

Sheet 21

1. C., C., C. & St. L. Ry. Co.
9. Ohio. 10. Moraine.
17. Injured man failed to exercise proper care.
18. Yard freight train standing.
24. (a) Harry O. Boyd, Columbus, Ohio. (b) A–143, local frt. engr. (c) Contusion of right ankle. (d) 16 days actual disability.
26. Injured man sitting on box in cab of engine, had his right foot braced on bolt on boiler while pulling reverse lever, apparently failed to exercise proper care and his foot slipped off bolt, and reverse lever caught foot between boiler and bolt. No defects.

Sheet 14

1. C., C., C. & St. L. Ry. (N.Y. Central R.R. Co., lessee).
9. Illinois. 10. Lawrenceville.
17. Handling reverse lever.
18. Yard freight standing.
24. (a) Frank M. Browne, Mt. Carmel, Ill. (b) A–144, yd. engr. (c) Contusion left leg, ankle and foot. (d) Eight days actual disability.
26. Attempting to put reverse lever in backward position and caught foot between seat box and lever. No defects.

1841

Sheet 6

1. Colorado and Southern Ry. Co.
9. Colorado. 10. Denver.
17. Caught foot between reverse lever and floor.
18. Switch train moving 3 miles per hour.
24. (a) A. J. Fink, Denver, Colo. (b) A–148. (c) Contusion of right great toe. (d) Four days actual disability.
26. While pulling back reverse lever on engine, his right foot became caught between the reverse lever and floor of engine.

Sheet 7

1. Clinchfield R.R. Co.
9. Virginia. 10. Nora.
17. Strained side while reversing engine.
18. Extra work train standing.

24. (a) S. F. Allen, Erwin, Tenn. (b) A–143, rd. frt. engr. (c) Strained left side. (d) Eight days actual disability.
26. Strained left side while reversing engine.

1842 Sheet 12

1. Central R.R. Co. of New Jersey.
9. New Jersey. 10. (Sound Shore Branch) Tremley Point.
17. 6316; operating reverse lever.
18. Extra freight, at rest.
24. (a) Lester Conover, 607 E. Second St., Plainfield, N.J., age 30. (b) A–143, rd. frt. engineer. (c) Lacerated wound of left foot. (d) 5 days' actual disability.
26. The above named had placed his left foot between reverse lever slide and air pipe leading from the floor of the cab to the automatic brake valve and when throwing reverse lever, his foot was caught between the slide and air pipe sustaining injuries shown above. Examination of the engine, reverse lever, slides, etc., developed no defects. In order to prevent the possibility of a similar occurrence, a wooden block has been placed between the end of the slide box and the air pipe.

Sheet 21

1. Central R.R. of New Jersey.
9. New Jersey. 10. Elizabeth.
17. Reverse lever came out of quadrant.
18. Pass. no. 439, speed 3 m.p.h.
24. (a) Joseph Furlong, 8 Story Court, Bayonne, N.J. (b) A–141, engineer rd. passgr. (c) Fracture of styloid process. (e) 60 days' probable disability.
26. The above named was engineman of train 439, engine 167, departing from Elizabeth Station at 9:06 p.m. After proceeding a short distance Furlong attempted to raise the latch of the reverse lever when the reverse lever came back with great force and pinned his left arm against the equalizing air pipe, sustaining injury as stated above. Investigation develops that accident was caused by one of the large studs that hold the guide yoke to frame working out and coming in contact with rocker arm.

Sheet 19

1. Central R.R. Co. of N.J.
9. New Jersey. 10. Brills Yard, Newark.
17. Negligence of employee.
18. Yard drill, speed 1 m.p.h.
24. (a) Harry Prime, Pt. Monmouth & Bingham, Keansburg, N.J. (b) A–144, yard rd. engr. (c) Spiral fracture of the proximal
1843 phalanx of the left little finger. (e) 21 days' probable disability.

26. While the above-mentioned employee, who was in charge of engine 440, was reversing engine, which was in forward motion, he struck small finger of left hand against cut-out box of train control on engine, sustaining injuries as stated above. Engine 440 inspected immediately after the accident and found to be in good condition. No defects in equipment.

Sheet 16

1. Central R.R. Co. of N. J.
9. New Jersey. 10. Unknown.
17. 6316, operating reverse lever.
18. Rd. frt., extra, speed unknown.
24. (a) A. E. Wilson, 153 Boyd Ave. (b) A–143, rd. frt. engr. (c) Slight strain of back; hernia (right side). (d) 9 days' actual disability.
26. The above-named reported on Aug. 16 that on July 30 while he was operating reverse lever of engine 483, which was on the main line drag starting out of Jersey City and working between Jersey City, Cartaret, Brills, and Elizabethport, the reverse lever worked hard, as result of which he sustained injuries shown above. On date in question engineer reported for duty at 3:15 a.m. and ceased work at 9:30 a.m.

Sheet 14

1. Central R.R. Co. of N. J.
9. Pennsylvania. 10. Siegfried.
17. Reversing engine.
18. Frt. extra, speed 0.
24. (a) John P. Flannery, 50, 111 North 6th St., Allentown, Pa. (b) A–142, rd. frt. engr. (c) Traumatic orchitis. (e) 30 days' probable disability.
26. Extra 453 stopped at Siegfried to set out cars and Engineer J. Flannery, in reversing engine, felt a sharp pain in intestines. He did not pay much attention to it for several days but it seemed to get worse and he reported off duty May 28. Employed as fireman Jan. 6, 1905, engineer *June 12, 1911.*

1844

Sheet 32

1. The Chesapeake and Ohio Ry. Co.
9. Kentucky. 10. Rush.
17. Quadrant bar of engine jumped forward catching his hand between top of bar & air pipe on boiler head, mashing two fingers.
18. Pass. train no. 26, speed 45 m.p.h.
24. (a) W. H. Meadors, Lexington, Ky. (b) A–141, engineer. (c) 4th finger on right hand cut and mashed. (d) 10 days' actual disability.

26. W. H. Meadors, engineer, age 63, shut off the steam when approaching Rush and took hold of the reverse lever for the purpose of lowering it in the quadrant, and in doing so the reverse lever jumped ahead with a violent lunge, catching his finger between the top of the bar and the air pipe on the boiler head, the reverse bar moving so far ahead account of the stop pin in front end of quadrant improperly placed, it being 4 inches too far ahead, allowing the bar to travel too far ahead and top end of bar striking the pipes on the boiler. Engine was taken to shops the same day and quadrant pin turned around in the proper manner. Meadors was attended by Dr. G. W. Moore, at Ashland, Ky.

Sheet 22

1. Chesapeake & Ohio Ry. Co.
9. West Virginia. 10. Thurmond Yd.
17. Reversing engine and strained back.
18. Frt. yd., standing.
24. (a) H. L. Neal, Thurmond, W.Va. (b) A–144. (c) Strained ligaments in back. (e) 30 days' probable disability.
26. Thurmond yard, 7:30 a.m., Dec. 25, Engineer H. L. Neal, in charge of yard engine 892, switching express car on no. 7, attempted to reverse engine, strained ligaments in back, no defect in equipment.

Sheet 5

1. Camas Prairie R.R. Co.
9. Idaho. 10. Oro Fino.
17. Rupture, operating reverse lever on engine 1630.
18. Frt. exa., starting.
24. (a) P. H. Bellmore, Lewiston, Idaho. (b) Engr. A–142. (c) In reversing engine threw reverse lever over suddenly, causing a rupture. (e) 15 days' probable disability.
26. —

1845 Sheet 21

1. Delaware and Hudson Co.
9. Pennsylvania. 10. Carbondale yd.
17. Operating reverse lever. No defects. Accidental.
18. Yard train at rest.
24. (a) James H. Murphy, Carbondale, Pa. (b) Employee A–144, yd. engineer. (c) Left hand sprained. (d) 5 days' actual disability.
26. The above-named engineer, while switching cars in yard and when in the act of reversing locomotive, reverse lever kicked back catching his hand between lever and back of engine cab, resulting in injury to extent mentioned above. Train service accident. Re-

versing locomotive under steam pressure. Hand caught. No defects or failure contributing. Accidental occurrence. Code 6316.

Sheet 12

1. Delaware and Hudson Co.
9. New York. 10. Colonie yard.
17. Operating locomotive. Reversing; foot caught; accidental.
18. Yard train, speed 2 m.p.h.
24. (a) Arthur R. Kilburn, Watervliet, N.Y. (b) Employee A–148, yd. fireman. (c) Bruised left foot (infected). (d) 14 days' actual disability.
26. The above-named yard fireman, while operating engine, in act of reversing, struck his foot against lever, sustaining slight bruise, same becoming infected later, resulting in injury to the extent mentioned above. Train service accident. Operating engine. Reversing. Struck reverse lever with foot. No defects or failure of locomotive contributing. Accidental. Code 6316.

Sheet 20

1. Delaware and Hudson Co.
9. Pennsylvania. 10. Carbondale yd.
17. Operating reverse lever on locomotive. No defects. Accidental.
18. Yd. train, speed 5 m.p.h.
1846. 24. (a) James A. Carey, Carbondale, Pa. (b) Employee, A–148, yd. fireman. (c) Right side strained. (d) 9 days' actual disability.
26. The above-named yard fireman, while in the act of operating locomotive and when throwing reverse lever, in some manner sustained injuries to the extent mentioned above. Train service accident. Operating locomotive. Strain. No defects or failure of locomotive to cause or contribute to accident. Accidental occurrence. Code 6333.

Sheet 19

1. Delaware & Hudson R.R. Corp.
9. Pennsylvania. 10. Plymouth yd.
17. Operating locomotive. Reversing engine. Sprain. Accident.
18. Local rd. frt., extra; speed, 4 m.p.h.
24. (a) Alex A. Reynard, Wilkes-Barre, Pa. (b) Employee, A–147, local rd. frt. fireman. (c) Right hand sprained. (d) 12 days' actual disability.
26. The above-named local road freight fireman, while operating locomotive and in the act of reversing locomotive, sustained injury to the extent mentioned above. Train service accident. Operating locomotive. Reversing. No defects or failure of locomotive contributing. Accidental occurrence. Code 6316.

Sheet 14

1. Delaware and Hudson Co.
9. New York. 10. Ninevah yard.
7. Operating locomotive; reverse lever operation. Strain. Accidental. No defects.
18. Yard train. Switching. Speed 5 m.p.h.
24. (a) C. P. Crum, Ninevah Junction, N.Y. (b) Employee, A–144, yd. engr. (c) Internal strain. (d) 8 days' actual disability.
26. The above-named yard engineer, while engaged in switching cars in yard and when in the act of reversing locomotive, received strain, resulting in injury to the extent mentioned above. Train-service accident—reverse lever operation. No defects or failure of locomotive to cause accident. Engine coming out of storage worked somewhat hard. Accidental occurrence. Code 6316.

1847 Sheet 9

1. Delaware, Lackawanna and Western R.R. Co.
9. Pennsylvania. 10. Scranton.
17. 6316, operating reverse lever, struck by same.
18. Pass. 46; speed 15 m.p.h.
24. (a) Arch G. Miller, Scranton, Penna. (b) A–141, rd. pass. engr. (c) Laceration right eye. (d) 5 days' actual disability.
26. While operating reverse lever, same came back very suddenly and struck eye, sustaining above injury. Nothing defective about equipment. Witness.

Sheet 7

1. Del., Lackawanna & Western R.R. Co.
9. New Jersey. 10. Summit.
17. (6388). Arm caught between reverse lever and gauge cock; injured.
18. Pass. extra; standing.
24. (a) Chas. H. Dunham, Hoboken, N.J. (b) A–141, rd. pass. engr. (c) Bursitis right elbow. (d) 24 days' actual disability.
26. Reversing engine to take slack out of train and in doing so arm caught between reverse lever and bottom gauge cock; injured as above. Nothing defective about equipment. No witnesses.

Sheet 9

1. Denver & Rio Grande Western R.R. Co.
9. Colorado. 10. Funston.
17. Caught foot between quadrant and reverse lever.
18. Frt. #85; speed 3 m.p.h.
24. (a) A. J. Decker, Grand Junction. (b) A–143, rd. frt. engineer, local frt. (c) Bruise and sprain large toe, right foot. (d) 9 days actual disability.

26. Engineer was attempting to reverse engine when he got his right foot too close to quadrant and in way of reverse lever, bruising and spraining large toe of right foot. Mechanical inspection of engine shows no defects that would in any way contribute to the injury. Engineer has had 21 yrs. experience in engine service.

1848 Sheet 14

1. Denver & Rio Grande Western R.R. Co.
9. Colorado. 10. Malta.
17. Unlatched reverse lever to reverse engine and lever went into backward motion immediately.
18. Frt. 2–42, standing.
24. (a) Frank M. Rupp. (b) A–142, frt. engr. (c) Sprain of right wrist. (d) 15 days' actual disability.
26. Inspection at Salida showed dash pot to reverse lever practically empty. After filling dash pot with oil reverse lever worked all right.

Sheet 40

1. Erie Railroad Co.
9. New York. 10. Suffern.
17. As described.
18. Frt. extra, stopped.
24. (a) J. Bellino, age 39. (b) Engineer A–143. (c) Right ingenuil [inguinal] rupture. (e) 60 days' probable disability.
26. While using reverse gear on engine was thrown to cab floor sustaining right ingenuil [inguinal] rupture.

Sheet 49

1. Erie Railroad Co.
9. Ohio. 10. Washingtonville.
17. Struck elbow on independent brake valve or sander.
18. Frt. 51, speed 5 m.p.h.
24. (a) J. L. Davison, age 54, Youngstown, Ohio. (b) A–143, rd. frt. engineer. (c) Contusion of right elbow. (e) 30 days' probable disability.
26. Was in the act of reversing engine while switching at Washingtonville, struck right elbow on either the independent brake valve or one of the air sander valves, sustaining injury shown above.

1849 Sheet 60

1. Erie R.R. Co.
9. New Jersey. 10. Jersey City.
17. As described.
18. Pass. light; standing.

24. (a) J. W. Dunlop, Chestnut St., Allendale. (b) Engineer A–141. (c) Bruised left instep. (d) 21 days' actual disability.

26. While standing at Hoboken Ave., account three engines crossing over, which were to couple onto above engine, Engineer Dunlop thought they would strike too hard and threw reverse lever forward, catching foot between lever and head of boiler. No defects.

Sheet 65

1. Erie R.R. Co.

9. New York. 10. Jamestown (main track).

17. Reverse lever operated hard due to engine just out of shop.

18. Frt. 182.

24. (a) Earl V. Jolley, 54 yrs., Meadville, Pa. (b) A–142, rd. frt. engineer (thru frt). (c) Strain of back (disability began about 1 p.m. Oct. 18). (d) 7 days' actual disability.

26. Engineer Jolley, on train 182, enroute Meadville, Pa., to Buffalo, N.Y., claims he noticed symptoms of injury to back when near Jamestown (at about 12:20 p.m.), caused by reverse lever working hard. The operating wheel to the reverse gear worked hard account of this being the first trip of engine out of Meadville shop. The motion work was new.

Sheet 63

1. Erie R.R. Co.

9. New York. 10. Lawtons (main track).

17. Globe valve on engine 2513 not in normal position.

18. Pass. 517.

24. (a) Wm. P. Connors, 41 yrs., Buffalo, N.Y. (b) A–141, rd. pass. engr. (c) Contusion of 4th finger, left hand. (e) 16 days' probable disability.

26. Train 517 made station stop at Lawtons, and in starting it was necessary to take slack and reverse engine 2513 to do so. While placing reverse lever in forward position, Engr. Connors had 4th finger of left hand caught between globe valve and reverse lever, due to insufficient clearance account of globe valve not in normal position.

1850 Sheet 32

1. Erie R.R. Co.

9. Ohio. 10. Niles.

17. Right thumb caught between latch and top of reverse lever.

18. Light engine.

24. (a) R. H. Jackson, Youngstown, Ohio. (b) A–128, hostler. (c) Thumb on right hand bruised. (e) 3 days' probable disability.

26. While moving reverse lever on engine 1692, thumb on right hand caught between latch and top of lever, breaking thumb on right hand. No defects.

Sheet 24

1. Erie R.R. Co.
9. New Jersey. 10. Jersey City.
17. As described below.
18. Frt. switch, standing.
24. (a) W. E. Nearpass, 219 Hoboken Rd., E. Rutherford, N.J. (b) A–141, yd. engr. (c) Sprain of muscles, right forearm. (d) 8 days' actual disability.
26. While pulling back lever on engine, it worked hard, resulting in injury.

Sheet 20

1. Erie R.R. Co.
9. New York. 10. Corning.
17. Reverse lever, operating.
18. Yd. serv., yd. eng., standing.
24. (a) Clude Curren, age 43, Elmira, N.Y. (b) A–144, yd. engr. (c) Sprain of left wrist. (d) 7 days' actual disability.
26. While reversing yard engine 1861 into back motion, caught arm between reverse lever and back end of cab, causing above noted injury. Inspection of engine developed no defective conditions to contribute to cause of accident.

1851

Sheet 1

1. Fort Street Union Depot Co.
9. Michigan. 10. Detroit.
17. —
18. Yard, speed 5 m.p.h.
24. (a) George Herron, Detroit, Mich. (b) A–144. (c) Left arm and wrist bruised. (e) 8 days probable disability.
26. While putting engine into reverse movement, Mr. Herron bumped elbow against back of cab. No defects in equipment.

Sheet 3

1. Fort Smith & Western Ry. Co.
9. Oklahoma. 10. Guthrie.
17. Operating reverse lever.
18. Work extra, speed 3 m.p.h.
24. (a) A. J. Pothast, Fort Smith, Ark. (b) A–142. (c) Right arm bruised. (d) 13 days actual disability.
26. Locomotive Engineer A. J. Pothast, while operating reverse lever caught his right arm between brake valve and reverse lever.

Sheet 48

1. Great Northern Ry. Co.
9. Montanta. 10. Bowdoin.
17. Reverse lever operated hard and engineer shoved too hard.

18. Light freight, starting.

24. (a) A. D. Killam. (b) A–143, local freight engineer. (c) Left shoulder wrenched. (e) 14 days probable disability.

26. 6:45 a.m., Jan. 24, at Bowdoin, Montana, Engineer A. D. Killam, age 50, when shoving reverse lever forward on engine 3336 he wrenched left shoulder account moving hard. Engineer claimed dry pipe leaking caused undue boiler pressure on reverse lever and made lever very hard to operate. Mechanical inspection of engine developed that brazing on collar to front end of dry pipe at flue sheet had broken allowing water to get into cylinders. Engine brought to Havre for repairs. This accident occurred in engine house preparatory to moving engine to local freight train no. 666 for which engine was called. Killam on duty 15 min. when injured and had 8 hrs. 5 min. rest before going on duty.

1852 Sheet 13

1. Great Northern Ry. Co.

9. Montana. 10. Stonehill.

17. Reverse lever went from forward to backward motion striking him on left knee.

18. Pass. 41; speed 10 m.p.h.

24. (a) C. P. Young, Whitefish, Mont. (b) A–141, pass. engr. & motorman. (c) Severe contusion of left knee, blood clot forming on knee. (e) 6 wks. probable disability.

26. Train (passenger) no. 41, engine 905 in charge of Engineer C. P. Young and Conductor Geo. T. Van was proceeding at rate of about 10 mi. per hr. Engr. Young had just shut off main throttle of engine, east of east switch at Stonehill & dropped reverse lever to half stroke preparing to stop when small brass plug in face of pressure plate worked out and fouled front valve strip, throwing reverse lever out of quadrant into backward motion, striking Engr. C. P. Young a glancing blow on left knee, causing severe contusion of [illegible] blood clot to form on knee. Medical attention received [illegible] Engr. Young is 55 yrs. of age & has been in service 21 yrs. Engine was brought to Whitefish for inspection which developed that when valve strip caught on brass plug it forced reverse lever back. Front valve strip being held at Whitefish for Federal inspection.

Sheet 15

1. Gulf, Colorado & Santa Fe Ry. Co.

9. Texas. 10. Temple.

17. Reversing engine and sprained ligaments of right forearm.

18. Yard; standing.

24. (a) W. J. Schluenz, Temple, Texas. (b) A–144, yd. engr. (c) Strained ligaments in right forearm. (d) 6 days actual disability.

26. While reversing engine, which was new and just out of back shop, the reverse lever hung in front corner, causing engineer to strain his arm. No defects.

Sheet 34

1. Grand Trunk Western.
9. Michigan. 10. Durand.
17. Caught arm between reverse lever and side of cab.
18. Frt. yard; stopped.
24. (a) Arthur J. Wescott, Durand, Mich. (b) A–144, yd. engineer. (c) Sprained right arm. (d) 7 days actual disability.
1853
26. Man claims while reversing engine he caught his right arm between reverse lever and side of cab.

Sheet 22

1. Illinois Central R.R. Co.
9. Louisiana. 10. New Orleans.
17. Throwing reverse lever.
18. Switch.
24. (a) Carl Weidert, New Orleans, La. (b) A–144, yd. engr. (c) Back sprained. (d) 9 days' actual disability.
26. In throwing reverse lever of engine his hand slipped off lever horn, thus causing reverse lever to jerk and wrench his back.

Sheet 24

1. Illinois Central R.R. Co.
9. Mississippi. 10. McComb.
17. Reversing engine.
18. Switch.
24. (a) N. E. Chadwich, 47, McComb, Miss. (b) A–144, yd. engr. (c) One rib left side fractured. (e) 10 days' probable disability.
26. While reversing engine he was struck in side by the lever. No defects.

Sheet 17

1. Illinois Central R.R. Co.
9. Mississippi. 10. Yazoo City.
17. Reversing engine.
18. Switch.
24. (a) E. A. Comfort, 55, Jackson, Miss. (b) A–144, yd. engr. (c) Slight fracture olecranon left elbow. (e) 15 days probable disability.
26. Claims lever kicked back when pulling on it to reverse engine. No defects.

1853a Sheet 7

1. International Great Northern Railroad Company.
9. Texas. 10. At Houston (Congress yd.).
17. Operating reverse lever on engine 275 with steam in cylinder.
18. Yard switch, standing.
24. (a) M. Sides, Houston, Texas. (b) A–148. (c) Strained abdomen muscle. (d) 7 days actual disability.
26. Was operating engine 275 on request of engineer. Sides claims in taking slack on 20 cars reverse lever hard to throw in forward position with steam in cylinder and to help throw over braced himself against back of cab with foot, straining abdomen muscle. No defect about engine.

Sheet 9

1. International Great Northern R.R. Co.
9. Texas. 10. Spring.
17. Foot caught between reverse lever and boiler.
18. Passenger train moving at 50 miles per hour.
24. (a) L. E. DelHomme, Houston, Texas. (b) A–141. (c) Abrasion of left ankle. (e) 24 days probable disability.
26. While above party was trying to let reverse lever down, his foot was caught between lever and boiler, he receiving above injuries. Above party states that he had his foot against boiler head for the purpose of bracing himself. Inspection of engine developed that clearance between lever and boiler is of the right gauge.

Sheet 7

1. Kansas City Southern Ry. Co.
9. Kansas. 10. Pittsburg.
17. Arm caught between reverse lever and back of cab.
18. Passenger train, standing.
24. (a) C. H. Lewis, engineer, Pittsburg, Kansas. (b) B–141. (c) Palm of left hand cut and bruised. (e) 30 days probable disability.
26. Engineer Lewis aided by his fireman was attempting to locate a pound in engine. In so doing they were putting the reverse lever in backward position and Lewis' elbow was caught against the back of cab in such a manner that the palm of his hand was cut and bruised.

1853b Sheet 1

1. Kansas, Oklahoma and Gulf Ry. Co.
9. Oklahoma. 10. Allen.
17. Struck right elbow on top of reverse lever after closing throttle.

18. Local freight, still.

24. (a) H. V. Cook, Muskogee, Okla. (b) A–143. (c) Right elbow bruised. (d) 8 days' actual disability.

26. While Engineer Cook was reversing engine 94 he struck right elbow on top of reverse lever, bruising elbow. No mechanical defects.

Sheet 24

1. Lehigh Valley Railroad Company.

9. Pennsylvania. 10. Sayre (yard track).

17. Slipped.

18. Yard service moving at 5 miles per hour.

24. (a) E. C. Tiffany, 402 W. Lockhard St., Sayre, Penna. (b) A–144, yard engineer. (c) Bruised right ankle. (e) 15 days' probable disability.

26. While reversing engine, foot slipped off foot rest and struck against reverse lever, causing bruise of ankle. No defects in equipment.

Sheet 24

1. Lehigh Valley Railroad Company.

9. New Jersey. 10. Jersey City yard track.

17. Block caught in quadrant.

18. Yard, stopped.

24. (a) George Cassady, 192 A. Claremont Ave., Jersey City, N.J. (b) A–144, yard engineer. (c) Severe sprain of right shoulder. (e) 30 to 60 days' probable disability.

26. Cassady was about to reverse lever when block caught in quadrant. He tried to pull lever, using such strength that he sprained the muscles of his right shoulder. The engine was repaired the same day.

1853c

Sheet 17

1. Lehigh Valley Railroad Company.

9. New Jersey. 10. Bloomsbury (yard track).

17. Reversing engine.

18. Freight train.

24. (a) Edwin M. Yerger, 217 Lachenour Ave., Easton, Pa. (b) A–142, road freight engineer. (c) Strained right upper arm and right shoulder. (d) 6 days' actual disability.

26. Engineer Yerger claims while shifting cars in Bloomsbury yard he strained right upper arm and shoulder while reversing engine. No defects.

Sheet 13

1. Lehigh Valley Railroad.

9. Pennsylvania. 10. Ashmore, main track at station.

17. Foot slipped.

18. Yard, standing.

24. (a) Herbert Setzer, Weatherly, Penna. (b) A–144, yard engineer. (c) Right foot sprained. (d) 15 days' actual disability.

26. While reversing engine 3139, braced himself by placing his right foot against reverse lever shield, foot slipped and he sprained same. No defect.

Sheet 12

1. Lehigh Valley Railroad.

9. New York. 10. Suspension Bridge yard track.

17. Oil can fell.

18. Yard.

24. (a) Frank Ringleb, 2892 McKoon Ave., Niagara Falls, N.Y. (b) A–144, engineer. (c) Laceration of second finger right hand. (e) 4 days' probable disability.

26. Engineer Ringleb was reversing engine 304 when oil can became displaced and fell in front of reverse lever. Ringleb's second finger of right hand became jammed between reverse lever and oil can resulting in the above-named injury.

1853d Sheet 2

1. Louisiana & Arkansas Railway Company.

9. Louisiana. 10. Tunica.

17. —.

18. Extra work train, standing.

24. (a) M. Brinkley, Baton Rouge, La. (b) A–144. (c) Right knee slightly sprained. (d) 9 days' actual disability.

26. Had foot on foot brace and sprained right knee while reversing engine #429.

Sheet 49

1. Louisville and Nashville Railroad Company.

9. Kentucky. 10. Hazard.

17. Claimed engine hard to reverse.

18. Yard train.

24. (a) E. A. Walker, Hazard, Ky. (b) A–144. (c) Orchitis, right, following strain. (d) 39 days' actual disability.

26. This engineer claimed he suffered a strain reversing his engine. He thought steam in the cylinders made reversing the engine difficult. The engine was carefully inspected and no contributory defect found. Further anent the second sentence above, the engineer seemed to think that a weak throttle latch spring let steam accumulate in the cylinders. As stated, the engine was inspected and no defect existed.

Sheet 53

1. Louisville & Nashville Railroad Company.

9. Alabama. 10. Clift.

17. Unlatched reverse lever and let it jerk away; hurt back trying to hold.

18. Extra freight train.

24. (a) J. O. Golden, Birmingham, Ala. (b) A–143. (c) Sprained back. (d) Four days' actual disability.

26. This engineer said he had opened the throttle full, starting up a grade, started to hook the engine up and when he released the latch the lever jumped forward. In trying to hold it back he hurt muscles of his back. The engine was subsequently inspected and no defective condition found.

1853e Sheet 38

1. Louisville and Nashville Railroad Company.

9. Georgia. 10. Bolton.

17. Strain of leg in efforts to hold reverse lever.

18. Passenger train running 35 miles per hour.

24. (a) E. C. Howell, Marietta, Ga. (b) A–141. (c) Sprain of muscles, left leg, hip. (d) 13 days' actual disability.

26. Engineer Howell said he unlatched the reverse lever to put it ahead a notch, bracing himself with left knee against the lever. The effort to prevent the lever from jumping to the forward limit of quadrant produced a strain of muscles of his left leg. There was no contributory defect about the equipment.

Sheet 25

1. Louisville and Nashville Railroad Company.

9. Kentucky. 10. Brandenburg.

17. Reversing engine, foot slipped.

18. Freight train.

24. (a) Clyde G. Morrison, Louisville, Ky. (b) A–142. (c) Bruises of back muscles; left shoulder. (d) 14 days' actual disability.

26. The engineer said he had trouble reversing the engine due to having stopped under pressure and cylinders were full of steam. His foot slipped and he fell out onto the deck of the engine. There was no contributory defect about the equipment.

1853f Sheet 28

1. Louisville & Nashville R.R. Co.

9. Illinois. 10. Belleville.

17. Hurriedly reversing engine, probably not properly braced.

18. Extra freight, standing.

24. (a) Theo. Schmidt, E. St. Louis, Ill. (b) A–143. (c) Back sprain; lumbago, lumbar muscles. (d) 15 days actual disability.

26. This engineer said he reversed his engine while switching, was in a hurry, and when he threw the lever a pain shot through his

back. He was in somewhat of a twist or strain when he made the move. He finished that day's work, but was unable to assume duties when called on the 18th, three days later. There was no contributory defect about the equipment.

Sheet 33

1. Louisville & Nashville R.R. Co.
9. Kentucky. 10. Pineville.
17. Reversing engine.
18. Extra freight; 12 m.p.h.
24. (a) C. S. Bruner, Emanuel, Ky. (b) A–142. (c) Sprained back. (e) 14 days probable disability.
26. This engineer said he hurt his back making a quick stop while switching, which necessitated reversing engine; he was in an awkward posture when the signal was given and he did not have time to straighten out. There was no contributory defect about the equipment.

Sheet 37

1. Louisville & Nashville R.R. Co.
9. Florida. 10. Goulding.
17. Engine working hard, lever jerked forward to end of quadrant.
18. Yard service cut, 3–4 m.p.h.
24. (a) L. C. West, Pensacola, Fla. (b) A–144. (c) Sprain, right wrist. (d) 14 days actual disability.
26. The engineer said they were making up a train, the engine was handling a heavy cut of cars and working hard. He was sitting somewhat in a twist, looking back for signals, as he reached for the reverse lever to hook the engine up a little. The lever failed to latch and jerked forward, spraining his wrist. There was no contributing defect about the equipment.

1853g Sheet 45

1. Louisville & Nashville R.R. Co.
9. Kentucky. 10. Winchester.
17. Strain, reversing engine; slight defect.
18. Passenger standing.
24. (a) C. B. Kinnard, Lexington, Ky. (b) A–141. (c) Severe abdominal strain. (d) 45 days' actual disability.
26. The engineer hurt himself reversing engine, trying to get started away from Winchester station. The difficulty experienced in reversing the engine was attributed to valve cap fouling valve of left steam chest. It is believed that a Bureau of Locomotive Inspection representative considered the trouble as due to an excessive amount of water in the boiler flushing the valves.

Sheet 5

1. Minneapolis & St. Louis R.R. Co.
9. Iowa. 10. Spencer.
17. Hand caught between reverse lever and latch.
18. Local frt.; 22 m.p.h.
24. (a) G. F. Swartz, Fort Dodge, Iowa. (b) Rd. frt. engr., A–143. (c) Third and fourth fingers of left hand bruised. (d) 6 days' actual disability.
26. G. F. Swartz, engineer, age 49, address Fort Dodge, Iowa. In service with this company 31 yrs. He was engineer, this date, on local freight no. 56, engine no. 643, running from Spencer to Fort Dodge, Iowa. Third and fourth fingers of right hand were bruised between lever and latch as he caught reverse lever when it came unlatched.

Sheet 13

1. Minneapolis & St. Louis R.R.
9. South Dakota. 10. Wallace.
17. Miscellaneous.
18. Freight standing.
24. (a) B. L. Shackle, Watertown, S.Dak. (b) Local frt. engineer, A–143. (c) Strained upper arm 2–20. (d) 18 days' actual disability.
26. While spotting a car of oil, and obeying the brakeman's signal for slack, he attempted to throw engine reverse lever over, and finding it worked very hard he put forth extra effort and 1853h strained the muscles in his right arm. Inspection of engine developed no defects, but the temperature was quite low on this date, which caused the mechanism to work harder than usual.

Sheet 7

1. Minneapolis & St. Louis R.R. Co.
9. Illinois. 10. Eleanor.
17. Assisting engineer to move reverse lever, palm of right hand blistered.
18. Freight; 50 m.p.h.
24. (a) J. W. Ford, Monmouth, Ill. (b) Road thru frt. fireman, A–146. (c) Palm of left hand blistered. (d) 12 days' actual disability.
26. Train in charge of Conductor F. L. Keyes and Engineer E. L. Howell, of Oskaloosa, Iowa. When one mile east of Eleanor, Ill., Fireman Ford was assisting Engineer Howell to move reverse lever and while he had hold of the lever with both hands the vibration on the lever on account of being in forward motion was so intense that it blistered the palm of his left hand. He was sent to Dr. J. L. Sherrick of Monmouth, Ill., for medical attention.

Sheet 1

1. Midland Valley R.R. Co.
9. Arkansas. 10. Hartford.
17. Caught left arm between reverse lever and back of cab while reversing engine.
18. Extra passenger, standing.
24. (a) George Friend, Muskogee, Oka. (b) A–141. (c) Left arm bruised and left wrist sprained. (e) 45 days' probable disability.
26. While reversing engine 30, Engineer Friend caught left arm between reverse lever and back of cab, bruising left arm and spraining wrist. No mechanical defects.

Sheet 4

1. Minneapolis, St. Paul & Sault Ste. Marie Ry.
9. Wisconsin. 10. Theresa.
17. Operating reverse lever of engine.
18. Passenger; 50 m.p.h.
24. (a) A. M. Fuller, Fond du Lac, Wis. (b) A–141. (c) Severe contusion of left hand; dislocation of thumb. (d) 7 days' actual disability.
1853i 26. Was moving reverse lever and in doing so put it in back-up position and the force of the lever threw his left hand back into the backboard of cab and pinned his arm in that position. No defective condition of reverse lever apparatus.

Sheet 4

1. Missouri & North Arkansas Ry. Co.
9. Arkansas. 10. Harrison.
17. Sudden jerk of locomotive when put in reverse.
18. Freight, standing.
24. (a) Wm. Hamm, Harrison, Ark. (b) A–142. (c) Sprained neck. (d) 7 days actual disability.
26. Wm. Hamm, engineer on northbound through freight train no. 212, engine no. 46, while standing in Harrison yard reversed engine and same jerked causing accident which resulted in an actual disability of seven days.

Sheet 5

1. Missouri and North Arkansas Ry. Co.
9. Missouri. 10. Fairview.
17. Jerked by lever on locomotive.
18. Extra freight, 5 m.p.h.
24. (a) Troy Thompson, Harrison, Ark. (b) A–142. (c) Strained back and side. (d) 10 days actual disability.

26. Troy Thompson, engineer on southbound through freight train no. extra, engine no. 42, moving at speed of 5 miles per hour in yard at Fairview, Mo., in attempting to move reverse lever was jerked, straining back and side. Accident resulted in an actual disability of ten days.

Sheet 4

1. Missouri & North Arkansas Ry. Co.
9. Arkansas. 10. Alpena.
17. Foot slipped.
18. Light engine, extra; 15 m.p.h.
24. (a) S. E. Anderson, Harrison, Ark. (b) A–142. (c) Mashed right foot. (d) 11 days actual disability.
26. Light engine no. extra 33 north, engine no. 33, moving at speed of 15 mi. per hour near MP–113. Engineer S. E. Anderson in trying to hook engine up, foot slipped off foot brace on quadrant when reverse lever jumped from his hand mashing right foot.

1853j

Sheet 42

1. Missouri Pacific R.R. Co.
9. Kansas. 10. Atchison.
17. Reversing engine.
18. Yard engine, standing.
24. (a) B. S. Cummings, Atchison, Kans. (b) A–144. (c) Swelling left cord to size of index finger and moderate amount of swelling left testicle. (d) 4 days' actual disability.
26. He was working as an engineer with yard engine no. 437, and while reversing engine the reverse lever worked hard, causing him to be injured.

Sheet 64

1. Missouri Pacific R.R. Co.
9. Arkansas. 10. Hope.
17. Reversing engine.
18. Yard engine, standing.
24. (a) J. Kizziar, Hope, Ark. (b) A–144. (c) Sprain of back. (d) 10 days' actual disability.
26. He was working as engineer with yard engine no. 514, and claims to have sprained his back while reversing said engine. Engine had just come out of shops and was stiff and hard to handle.

Sheet 72

1. Missouri Pacific R.R. Co.
9. Missouri. 10. Scott.
17. Reversing engine caught.
18. Freight, standing.

24. (a) Frank Boyce, Jefferson City, Mo. (b) A–142. (c) Sprain of left wrist. (d) 37 days' actual disability.

26. He was working as an engineer with engine no. 1210 of frt. train no. 50 and was backing engine into siding for no. 15, and in reversing engine caught left arm between reverse lever and cab of engine, spraining left wrist.

Sheet 7

1. Missouri-Kansas-Texas R.R. Co.

9. Missouri. 10. St. Charles.

17. Engr. pilot got finger caught and mashed by reverse lever.

1853k 18. Passenger standing.

24. (a) J. S. Simcoe, Moberly, Mo. (b) A–141. (c) Nail and tip of third finger, left hand, clipped off. (e) 14 days' probable disability.

26. M.-K.-T. train #5, engine 359, in charge of Conductor Phillips, Engr. Parks, detouring St. Louis to Moberly, over Wabash, Aug. 11, account river slide on M.-K.-T. main line at Hamburg, was at St. Charles when M.-K.-T. Engr. Parks in reversing engine, Wabash Engr.-Pilot J. S. Simcoe being with him in the cab and at the time had his left hand on the throttle quadrant, got nail and tip of third finger, left hand, clipped off when reverse lever went back against stop block at end of quadrant. Train was held 30 min. for medical treatment, after which proceeded, Engr.-Pilot Simcoe completing trip, but laid off on arrival Moberly, probable disability 14 days. Inspection of engine showed no defects.

Sheet 13

1. Missouri-Kansas-Texas R.R. Co.

9. Oklahoma. 10. Adair.

17. Foot slipped on deck, while reversing engine in forward motion.

18. Local train standing.

24. (a) J. R. Lukens, Muskogee, Okla. (b) A–143. (c) Back and left side sprained. (e) 18 days' probable disability.

26. This crew was engaged in doing the station switching at Adair and while engine 731 was standing still on team track, Engr. J. R. Lukens was standing on the reversing lever quadrant platform, and between the reversing lever and the engineer's seat, and in attempting to put engine in forward motion, his foot slipped off this platform, causing him to wrench his back and left side. The injury was reported at Pryor, and Engr. Lukens was attended by company surgeon, Dr. Sylba Adams, who bandaged up Engr. Lukens' back, and he was taken to Muskogee in the caboose on the local, where he received further treatment from company surgeon, Dr. Pat Fite. Inspection of the engine developed there were no defects in engine, ex-

cept that the engine was new and just out of the overhauling shop, therefore, the reversing lever was working stiff on this account. This engineer ran this engine from Muskogee to Vinita the previous day and was thoroughly familiar with the condition of the engine and what was necessary to handle her safely. It is apparent that had Engr. Lukens gotten down in the deck, or on the outside of the reversing lever, instead of standing between reversing lever and his seat, he would have been in position to handle the reversing lever without any strain to his back and side. This engine was inspected at Muskogee for defects and nothing was found wrong, except engine new and stiff. Injured party has not as yet resumed service, but expects to resume his duties on May 9, in which event he will have lost 18 days' time as a result of his injury.

18531

Sheet 26

1. New York Central R.R. Co.
9. Michigan. 10. Tecumseh Junction.
17. Reverse lever flew back.
18. Passenger; 8 m.p.h.
24. (a) James J. Lynch, Toledo, Ohio. (b) A–141, rd. pass. engr. (c) Left wrist broken. (e) 90 days' probable disability.
26. Right valve stem broke and when injured man attempted to move reverse lever in forward motion after shutting off throttle, the reverse lever kicked back, striking arm. Engine involved inspected by I.C.C. inspector at Adrian, Mich. Cause of failure not known at this time.

Sheet 36

1. New York Central R.R. Co.
9. New York. 10. Palmyra.
17. Unexpected turn of reverse-gear wheel.
18. Passenger, standing.
24. (a) Wm. V. Ryan, Batavia, N.Y. (b) A–145, rd. pas. fireman. (c) Fracture of right wrist. (d) 61 days' actual disability.
26. A quick and unexpected turn of reverse-gear wheel twisted his right hand.

Sheet 35

1. New York Central R.R. Co.
9. New York. 10. Catskill.
17. Reverse lever worked hard.
18. Freight.
24. (a) Joseph A. Maynard, Albany, N.Y. (b) A–143, rd. frt. engineer. (c) Back sprained. (e) 21 days' probable disability.
26. Was throwing reverse lever of engine just out of shop, and account of same working hard, he sprained his back.

Sheet 43

1. New York Central R.R. Co.
9. New York. 10. Richland.
17. Handling reverse lever when it got away from him.
18. Passenger; 45 m.p.h.
1853m 24. (a) James Brown, Oswego, N.Y. (b) A–141, road pass. engineer. (c) Fracture of radius and ulna of right arm. (e) 61 days probable disability.
26. While handling reverse lever it got away from him and threw his ——— against boiler head. No defects.

Sheet 28

1. New York Central R.R. Co.
9. New York. 10. Watkins.
17. Handling reverse lever.
18. Passenger, standing.
24. (a) John F. Hickey, Corning, N.Y. (b) A–145, rd. pass. fireman. (c) Hernia. (e) 70 days probable disability.
26. Strained himself while assisting engineman to move reverse lever. No defects.

Sheet 20

1. New York Central R.R. Co.
9. New York. 10. Lake View.
17. Reverse lever failed to latch.
18. Passenger; 10 m.p.h.
24. (a) Alfred J. Haines, Cassadaga, N.Y. (b) A–141, rd. pass. engineer. (c) Right shoulder sprained. (d) 6 days actual disability.
26. While handling reverse lever, he claims that it jerked back and forth account of failing to latch, straining right arm and shoulder.

Sheet 14

1. New York Central Railroad Co.
9. New York. 10. Dunkirk.
17. Reverse gear worked hard.
18. Passenger, standing.
24. (a) Raymond McDonald, Huron, Ohio. (b) A–141, rd. pass. engr. (c) *Wr*ight wrist strained. (d) 6 days actual disability.
26. While operating reverse gear on engine it worked hard and he strained his wrist.

1853n Sheet 53

1. New York Central Railroad Company.
9. Illinois. 10. Streator.
17. Lost balance, apparently due to motion of engine.

18. Freight, 30 m.p.h.

24. (a) John F. Leonard, Kankakee, Ill. (b) A–142, rd. frt. engr. (through). (c) Contusion and laceration of left foot and leg above ankle. (e) 35 days probable disability.

26. In reducing speed of engine, injured person was using reverse lever to "cushion" the engine, and lever flew out of grasp and caught left foot between the lever and boiler head. He was bracing himself with left foot against boiler head. No unusual motion of engine. No defects.

Sheet 23

1. New York Central R.R. Co.

9. New York. 10. Clayton.

17. Latch on reverse lever slipped down.

18. Passenger, standing.

24 (a) Frank H. Smith, Watertown, N.Y. (b) A–141, rd. pass. engineman. (c) Left hand bruised. (d) 3 days actual disability.

26. Reversing engine. Latch on reverse lever slipped from hand and weight was thrown against hand. No defects.

1853o

Sheet 16

1. New York, Chicago & St. Louis R.R.

9. Indiana. 10. Indianapolis.

17. Reverse lever caught hand.

18. Extra freight moving 10 miles per hour.

24. (a) Charles Patch, Peru, Ind. (b) Engineer A–142. (c) Injured right hand bruised and cut. (e) Thirty days' probable disability.

26. Reverse lever caught hand and bruised and cut same.

Sheet 18

1. N. Y., Chicago & St. Louis R.R. (Cloverleaf district).

9. Illinois. 10. Charleston.

17. Caught hand between reverse lever and back wall.

18. Yard train, standing.

24. (a) C. N. Newman, Charleston, Ill. (b) Yd. engr. A–144. (c) Bruising back of hand and spraining ligaments. (e) 30 days' probable disability.

26. Caught right hand between top of reverse lever and back wall bruising and spraining ligaments.

Sheet 16

1. N. Y., Chi. & St. Louis R.R. (Clover Leaf dist.).

9. Illinois. 10. Melwood.

17. Caught finger in reverse lever latch.

18. Local moving 10 miles per hour.

24. (a) D. Donaldson, Charleston, Ill. (b) Engineer A–143. (c) Mashed finger.

26. Caught finger in reverse lever latch while hooking lever up, it suddenly flew up to corner catching his finger.

1853p Sheet 16

1. N.Y. Chi. & St. Louis R.R. (Clover Leaf dist.).
9. Indiana. 10. Russiaville.
17. Reverse lever caught foot.
18. Freight moving 35 miles per hour.
24. (a) G. C. Banta, Frankfort, Ind. (b) Fireman A–146. (c) Broken bone in foot. (e) 30 days probable disability.
26. Reverse lever went into corner and caught his foot between the boiler head and reverse lever.

Sheet 7

1. N. Y. C. & St. L. (L. E. & W. dist.).
9. Indiana. 10. La Porte.
17. Assisting engineer to start train on reverse lever.
18. Freight train, standing.
24. (a) Paul W. Lucy, Peru, Ind. (b) A–146, fireman. (c) Contusion of palm of hand. (d) 17 days actual disability.
26. Injured palm of hand assisting engineer to start train on reverse lever.

Sheet 11

1. Nashville, Chattanooga & St. Louis Ry.
9. Tennessee. 10. Belmont.
17. Reverse lever jerked out of hand.
18. Passenger moving 35 miles per hour.
24. (a) John Anderton, age 57, Tullahoma, Tenn. (b) A–141. (c) End of left big toe mashed. (e) 30 days probable disability.
26. Had left foot against brake valve, pulling reverse lever back, when lever jerked out of hand, dropping down on foot, mashing end of left big toe.

1853q Sheet 18

1. Nashville, Chattanooga & St. Louis Ry.
9. Tennessee. 10. Fayetteville.
17. Reversing engine while cylinders were filled with steam.
18. Extra freight, standing.
24. (a) H. Street, age 32, Decherd, Tenn. (b) A–147. (c) Back strained. (d) 14 days' actual disability.
26. While assisting engineer in reversing engine, with cylinders full of steam, strained back.

Sheet 14

1. Nashville, Chattanooga & St. Louis Ry.
9. Tennessee. 10. Nashville.
17. Reversing engine.
18. Light engine, standing.
24. (a) S. Hailey, Nashville, Tenn. (b) A–142. (c) Wrenched back.
26. Power reverse piston rod broke on engine out on line of road, and this man was trying to reverse engine with shaker bar when he sprained his back.

Sheet 29

1. N.Y., New Haven & Hartford R.R.
9. Massachusetts. 10. Forest Hills yd.
17. Claims reverse lever operated hard.
18. Freight LB 2, standing.
24. (a) G. Doran, 116 Barnby St. (b) A–143, rd. frt. engr., local and way freight. (b) Right wrist sprained. (e) 60 days' probable disability.
26. Engineer Doran was operating engine 1311, on train LB 2, and was switching at Forest Hills, Mass., yd. In pulling reverse lever over from forward to back gear in making one of these switching moves, he claims to have strained the ligaments in his right wrist. Engine 1311 was inspected at Southampton St. enginehouse by general foreman, and no defective condition was found in reverse lever or valve motion Nov. 9, 1929.

1853r

Sheet 44

1. N.Y., New Haven & Hartford R.R. Co.
9. New York. 10. Briggs.
17. Foot slipped while pulling on reverse lever.
18. Extra work train, standing.
24. (a) William F. Delaney, Poughkeepsie, N.Y. (b) A–143, rd. frt. engr., local frt. (c) Strained muscles of abdomen. (e) 30 days' probable disability.
26. Delaney was pulling on reverse lever when his foot slipped, resulting in strain of muscles of abdomen. Inspection of this engine developed no defect that would be responsible for the injury.

Sheet 23

1. N.Y., New Haven & Hartford R.R. Co.
9. Connecticut. 10. Newfield yard.
17. In making back-up movement with reverse lever he got his hand caught.
18. Extra freight moving 3 miles per hour.

24. (a) Chas. F. Strelau, 135 Liberty St., Middletown, Conn. (b) A–143, rd. frt. engr., local. (c) Left wrist sprained. (d) Five days' actual disability.

26. While switching cars at Tuttle's #4 brick yd., working engine forward and backward, in making a back-up movement with reverse lever, he got his hand caught between reverse lever and back of cab. He made no report of the occurrence at the time. Engine is standard, and inspection by engine inspector at East Hartford on date of occurrence developed no defects. Engine is of K–1–b class, type 2–6–0, built by American Locomotive Works in 1904, weight on drivers 130,000 lbs., total engine 151,000 lbs., & tender 265,000 lbs., wheel arrangement, pony truck, and 3 drivers.

1853s Sheet 41

1. N.Y., New Haven & Hartford R.R. Co.

9. Conn. 10. Meriden.

17. In changing position of reverse lever it went down in corner, taking him with it.

18. Passenger train moving 20 miles per hour.

24. (a) A. Rice, 294 Howard Ave., New Haven, Conn. (b) A–141, rd. pass. engr. (c) Back strained. (e) 15 days' probable disability.

26. As train was pulling into Meriden Station, Engineer Rice shut off steam, and in changing position of reverse lever, it went down in the corner, pulling him with it, straining his back. A thorough examination was made of the engine upon arrival at Springfield by foreman, same date, and nothing was found wrong with the appurtenances or the handling of the lever.

Sheet 23

1. N.Y., New Haven & Hartford R.R. Co.

9. Ms. (?). 10. Millville yd.

17. Engineer strained left side of neck while attempting to move lever of engine to forward gear.

18. Extra freight train moving 4 miles per hour.

24. (a) E. Sullivan, 152 Oakland Ave., Providence, R.I. (b) A–143, rd. frt. engr. (local & way frt.). (c) Muscles in left side of neck strained. (d) Five days' actual disability.

26. Mr. Sullivan, employed as an engineer, was engaged in operating engine 414. While switching cars at the freight yard he claims the brake was in back gear, and when he let brake off to make a move ahead he took hold of reverse lever in back gear to move to forward gear, at which time lever was brought to about half stroke in back gear, engine moving, causing the reverse lever to go into full back gear, and his arm was given such a pull that muscles in neck were strained. He continued on with his work until April 20, when

he reported off, returning April 24. Inspection of engine on April 25 by foreman at Providence developed that reverse lever had too much clearance between face of quadrant and face on dog, distance between being 5/8" and it should be 1/8". Inspection of this engine previous to accident was made on April 12, 4:35 p.m., by foreman inspector, Providence engine house, and no defects were noted.

1853t Sheet 25

1. N. Y., New Haven & Hartford R.R. Co.
9. Conn. 10. East Haven.
17. Claims that hand slipped off reverse lever and he fell against corner of cab.
18. Passenger, 2nd 2, moving 20 miles per hour.
24. (a) William S. Brainerd, West Haven, Conn. (b) A–141, rd. pass. engineer. (c) Back strained. (d) 12 days actual disability.
26. He claims that while attempting to move reverse lever nearer center account of having been slowed by signal, and his hand slipped and lever kicked and he lost his balance and was thrown against corner of cab sustaining injuries to his back. He continued to work to Boston and back as far as Midway where he was relieved from duty. He was an experienced man. Engine was inspected on arrival at Boston and no contributory defects found. Engine was inspected prior to departure from Cedar Hill engine house on morning of April 25 and found to be in good condition.

Sheet 31

1. N. Y., New Haven and Hartford R.R. Co.
9. Connecticut. 10. Midway.
17. Careless operation of engine.
18. Work service train—extra, moving 3 miles per hour.
24. (a) L. G. McLaren, Midway, Conn. (b) Rd. frt. fireman (thru frt.). (c) Right instep bruised. (d) 8 days actual disability.
26. Was operating engine of wrecking train in absence of engineer and in pulling reverse lever over in back gear had his foot in careless position, resulting in it being jammed between bottom of quadrant and reverse lever. Engine was not defective.

1853u Sheet 26

1. N.Y., New Haven & Hartford R.R.
9. Conn. 10. Hampton.
17. Left link block seized in link.
18. Passenger, moving 45 miles per hour.
24. (a) Geo. J. Kingston, Dartmouth St. (b) A–141, engr, rd. pass. (c) Right chest bruised and right forearm strained.
26. Engr. Kingston had been having more or less trouble with the reverse lever all the way down and was easing it ahead a little at

Hampton station when the quadrant got adrift from the frame, causing the lever to strike him on the right chest and right forearm. Fireman rebolted quadrant to the frame while train was in motion and engr. run to Hartford, where change was made for 1326. Inspection of engine by mechanical inspector developed that the left link block was seized in link, which in turn caused slight damage to right link block and quadrant to become loose in cab. Both blocks were eased off and replaced on engine. Engine was inspected by mechanical inspector at Boston just previous to its going out on train 119 and no exceptions taken. Engine crew was on duty at time of accident 2 hrs. 55 min. Off duty 32 hrs. 40 min. Engine 1327, type 4–6–2; built by Amer. Loco. Co., 1913. Placed in service same year. Weight of engine 251,500 lbs. Engine and tender 384,100 lbs.

Sheet 22

1. N.Y., New Haven & Hartford R.R.
9. Conn. 10. Meriden.
17. In operating reverse lever he strained his back.
18. Freight switcher, moving 3 miles per hour.
24. (a) Geo. H. Brady, Myrtle Ave., West Haven, Conn. (b) A–144, yd. engr. (c) Chest, left side, and back strained. (d) 11 days' actual disability.
26. He had previously had his thumb injured on same date and claims it was necessary to operate reverse in such a way due to injury to thumb that he sustained strain of chest muscles and back, and he called in his family physician, who pronounced it a case of dry pleurisy which could be the result of the strain he received. Inspection of engine developed no defects.

1853v Sheet 28

1. N.Y., New Haven & Hartford R.R.
9. Mass. 10. Braintree.
17. Finger caught in reverse lever latch on engine.
18. Passenger train moving 20 miles per hour.
24. (a) Even S. Stone, Watertown, Mass. (b) A–141, rd. pass. engr. (c) First finger on left hand fractured and lacerated. (e) 42 days' probable disability.
26. After leaving Braintree station, engineer states that he was hooking up reverse lever, but was unable to latch it, lever going back and throwing him in corner of cab, catching first finger of his left hand between lever and the handle on reverse latch. On arrival at Boston, engine was immediately inspected by foreman mechanical inspector and no defect found in reverse lever, and it was also found to be working smoothly and properly.

Sheet 3

1. N.Y., Ontario & Western Ry. Co.
9. New York. 10. Middletown.
17. Reverse lever unlatched; caught sleeve.
18. Yard (?) train moving 2 miles per hour.
24. (a) Edwin R. Callender, Middletown, N.Y. (b) A–144. (c) Contusion and bruise of left shoulder.
26. While switching, reverse lever unlatched and went in forward motion, throwing him forward. Engine and appliances in good condition.

Sheet 11

1. Norfolk and Western Ry. Co.
9. Virginia. 10. Nottoway.
17. Reverse lever operating.
18. Passenger train moving 4 miles per hour.
24. (a) R. S. Chapman, Drewe, Va. (b) A–141, road pass. engr. (c) Contusion of muscles of instep of left foot. (d) Five days' actual disability.
26. Pass. train no. 6, engine 544, east, with 5 passenger cars, all air and in service, was making station stop at Nottoway, Va., when Road Passgr. Engineman R. S. Chapman had his left foot caught between reverse lever and boiler head, injuring him slightly. When engineer shut the engine off preparatory to making station stop he had his left foot in advance of the reverse lever, and when he 1853w attempted to lower the lever, same slipped out of his hand, going forward, catching his left foot between reverse lever and boiler head. There was nothing wrong with engine or reverse lever. Injury was due to fact that Chapman failed to hold reverse bar after he disengaged latch from quadrant. He had been in service 38 years, with 9 hrs. rest, and on duty 4 hrs. 30 min. when injured.

Sheet 22

1. Norfolk & Western Ry. Co.
9. Virginia. 10. Island (yd.).
17. Reverse lever, operating.
18. Extra freight train.
24. (a) C. H. McDaniel, Roanoke, Va. (b) A–142, rd. frt. engineman. (c) Left thumb dislocated. (d) 11 days' actual disability.
26. Light freight engine no. 2031 was standing on Island yard and Rd. Frt. Engineman C. H. McDaniel attempted to reverse lever and when doing so wheel to precision reverse gear hung causing him to throw his entire weight on left thumb, dislocating same. Investigation develops there was nothing defective or irregular about the engine. Injured party has been in the service 36 years with 12 hrs. rest and on duty 6 hrs. when injured.

Sheet 20

1. Northern Pacific Ry. Co.
9. Montana. 10. Forsyth yard.
17. Mishap.
18. Extra freight.
24. (a) Dan Harrington, rd. frt. engr., Glendive, Mont. (b) A–142. (c) Back strained. (d) 14 days' actual disability.
26. Engr. Harrington had taken his engine off the roundhouse track at Forsyth to the east switch of the switch lead and intended back in on the switch lead to pick up his train and claims that when he reversed his engine he sprained his back. Supt. advises that it was found that the reverse lever works rather hard, but it also is a fact that the injury on this occasion was due to the position in which he was standing handling the reverse lever and with a little more care could have avoided the injury.

1853x Sheet 14

1. Northern Pacific Ry. Co.
9. Minnesota. 10. Darling pit.
17. Mishap.
18. Work extra.
24. (a) E. L. Barton, road work train engineer, Minneapolis, Minn. (b) A–143. (c) Strained muscles of back. (d) 11 days' actual disability.
26. Engr. Barton says he was reversing engine 1178 while at Darling gravel pit and claims that the reverse lever worked hard with the result that he sprained the muscles of his back. He says there was nothing defective about the engine. Inspection of engine 1578 showed no defects.

Sheet 22

1. Northern Pacific Ry. Co.
9. Washington. 10. Pasco yard.
17. Apparently due to injured man's negligence.
18. Switch train.
24. (a) P. C. Schlagel, yd. engr., Pasco, Wash. (b) A–144. (c) Contusion of elbow. (d) 7 days' actual disability.
26. Engr. Schlagel states that while throwing the reverse lever from forward to backward motion he got his arm between reverse lever and back of cab and the momentum of the lever drove his elbow against the cab. Master mechanic examined engine and stated there was plenty of room between lever and cab, that the injury was due to awkward position in which he held his arm and that the injury was the result of getting arm between reverse lever and the cab while in the extreme backward motion and his elbow struck the cab while throwing the reverse lever backward. Injury was due to his own carelessness.

1853y

Sheet 60

1. Pennsylvania R.R., western region.
9. Ohio. 10. Toledo.
17. 6316, bumped hand on reverse lever.
18. Passenger train, standing.
24. (a) M. J. Printy, Toledo, Ohio. (b) Passenger engineman, A-141. (c) Second finger left hand dislocated. (d) 5 days' actual disability.
26. Bumped hand on screw reverse when he turned to reverse engine.

Sheet 64

1. Pennsylvania R.R., western region.
9. Indiana. 10. Logansport.
17. 6316, reverse lever operation.
18. Yard train at rest.
24. (a) J. A. Wagner, Logansport, Ind. (b) A-144 yard engineer. (c) Right ingunial hernia. (d) 19 days' actual disability.
26. In reversing engine, foot slipped off foot brace, allowing body to pitch forward and strike reverse lever. Reported to Bureau of Locomotive Inspection.

Sheet 44

1. Pennsylvania R.R., western region.
9. Indiana. 10. Reagan.
17. 6316, operating reverse lever.
18. Passenger train, moving 50 miles per hour.
24. (a) G. J. Lauterbach, Logansport, Ind. (b) A-141, road passenger engineer. (c) Right ankle sprained. (e) 30 days' probable disability.
26. Operating reverse lever when it slipped from his hands and caught leg between lever and boilerhead. No defective equipment.

1853z

Sheet 122

1. Pennsylvania Railroad Company, eastern region.
9. Pennsylvania. 10. Williamsport.
17. 6316, operating reverse lever of locomotive.
18. Yard engine, standing.
24. (a) J. G. B. Matchett, Williamsport, Penna. (b) A-144, yard engineman. (c) Strain of right sacrioliac joint. (d) 14 days' actual disability.
26. While throwing reverse lever of locomotive in forward motion sustained above injury. No defects. No corrective action necessary. Accident attributed to manner in which he operated lever.

Sheet 63

1. Pennsylvania Railroad Company, eastern region.
9. Pennsylvania. 10. Ardmore.
17. 6316, operating reverse lever.
18. Extra freight train, moving 10 miles per hour.
24. (a) F. E. Speas, Paoli, Penna. (b) A–142, through freight rd. engineman. (c) Fracturing a bone in left hand. (e) 45 days' probable disability.
26. While operating reverse lever, it failed to catch in rack, flying back, striking him on left hand. Reported to Bureau of Locomotive Inspection.

Sheet 78

1. Pennsylvania Railroad, eastern region.
9. Delaware. 10. Delmarva.
17. 6316, reverse lever, operating.
18. Passenger train, standing.
24. (a) H. S. Kennan, Delmar, Del. (b) A–141, road passenger, engineman. (c) Fracture 8th right rib. (d) 16 days' actual disability.
26. Releasing reverse lever from back motion, lever alleged to be caught up. Engine examined by motive power officer after accident and no defect found—continued in service. Reported to Bureau of Locomotive Inspection.

1853aa Sheet 93

1. Pennsylvania Railroad, central region.
9. Pennsylvania. 10. South Duquesne.
17. 6316, struck by reverse lever.
18. Yard train, moving 7 miles per hour.
24. (a) C. N. Ryan, Uniontown, Penna. (b) A–144, yard engineer. (c) Left wrist fractured. (e) 45 days' probable disability.
26. When engineer attempted to drop reverse lever a few notches on quadrant the reverse lever became unlatched and the locomotive working under steam, the lever went to full stroke on quadrant and struck his arm. Equipment not defective.

Sheet 8

1. Pennsylvania Railroad Company, central region.
9. Pennsylvania. 10. Driftwood.
17. 1888, giving and accepting improper block permission.
18. Freight passenger train moving 5 miles per hour; extra stopped.
24. (a) S. A. Girts, East Brady, Pa. (b) A–145 road passenger fireman. (b) Sprain, right ankle and foot. Slight contusion, right knee. (e) 21 days' probable disability.

26. Engine 6248, side collided with engine 6268, damaging and derailing both engines, due to operator giving and engineman and conductor of extra 6248 accepting block permission in an improper manner.

The above named, in attempting to avoid collision, had foot caught between reverse lever and seat box of engine 6268, while reversing engine.

Sheet 89

1. Pennsylvania Railroad, central region.
9. Pennsylvania. 10. Scully yard.
17. 6316, operating reverse lever.
18. Yard train moving three miles per hour.
24. (a) E. I. Shean, Caregie, Pa. (b) A–144, yard engineman. (c) Sprain of right side of back. (d) 20 days' actual disability.
26. It is alleged by Engineman Shean that while he was reversing engine 8624 he sprained the right side of his back. Reverse lever in good operating condition. Reported to Bureau of Locomotive Inspection.

1853bb

Sheet 14

1. Pere Marquette Railway Company.
9. Michigan. 10. Uhl.
17. Reverse lever jumped out of quadrant and struck leg.
18. Extra freight train moving 25 miles per hour.
24. (a) Jesse E. Crossett Grand Rapids, Mich. (b) A–142. (c) Fracture of tibia and fibula, left leg. (e) 60 days' probable disability.
26. Extra 365 travelling at a speed of about 25 miles per hour, when for some unknown reason reverse lever slipped out of quadrant and jumped ahead, striking Engineer Crossett on the left leg. Reverse lever was inspected thoroughly and no defects could be found.

Sheet 4

1. Portland Terminal Company.
9. Maine. 10. Portland.
17. Engine stalled.
18. Switcher starting.
24. (a) A. McLean, South Portland, Maine. (b) A–144. (c) Bruised left elbow. (e) 60 days' probable disability.
26. Angus McLean, engineer, South Portland, sprained his left elbow causing acute bussitis, requiring operation. During snowstorm the engine became stalled in snow and throwing lever back and forth caused the injury.

Sheet 26

1. Reading Company.
9. Pennsylvania. 10. 22nd St. (yd.).
17. Operating reverse lever of engine. No defects.
18. Freight shifter at rest.
24. (a) Charles H. Klitsch, 4532 N. Hicks St., Philadelphia, Pa. (b) A–144, yard engineman. (c) Small of back sprained. (e) 50 days' probable disability.
26. Yard engine 1399 was shifting in 19th St. Yard when Engineman Chas. H. Klitsch, while operating reverse lever to move in backward motion claims to have strained his back. Subsequent investigation of engine at the roundhouse fails to show any defects in locomotive appurtenances.

1853cc Sheet 40

1. Reading Company.
9. Pennsylvania. 10. Womelsdorf (sdg.).
17. Reverse lever, operating; no defect.
18. Extra freight train, standing.
24. (a) Harvey Barr, Harrisburg, Penna. (b) A–143, road freight engineman (way frt.). (c) Sprain, muscles in back. (d) 25 days' actual disability.
26. Crew was engaged in moving 14 cars and caboose in way freight service between Reading and Rutherford. Engine moved onto the Lavino brick works track to do some shifting and when engineman was reversing engine to back off this track with several cars coupled to front end of engine he twisted his body in such a manner as to sustain injury noted above. No defect. Engine not in motion. Consulted physician.

Sheet 24

1. Reading Company.
9. Pennsylvania. 10. Hershey, causing reverse bar to fly back.
18. Extra shifter, moving three miles per hour.
24. (a) John W. Boyer, Lebanon, Pa. (b) A–144; yard engineman. (c) Bruise, right knee. (d) 10 days' actual disability.
26. Crew was engaged in traveling shifting service between Lebanon and Hummelstown. Engine 1026 backed on #8 track at Hershey Chocolate Company yard with three cars back of tender to place one car on #8 track. Engineman reversed engine and gave it steam when the engine reverse bar flew back, due to reverse lever latch not holding account being worn, striking his knee.

Sheet 41

1. Reading Company.
9. Pennsylvania. 10. Lebanon.
17. Twisting body when reversing engine.
18. Extra shifter moving two miles per hour.
24. (a) Jacob L. Bixler, Lebanon, Penna. (b) A–144, yard engineman. (c) Sprained muscles in back. (d) 14 days' actual disability.
26. Crew was engaged in shifting service in Lebanon Yard territory. Engine was pulling out of Wrought Iron Co. plant with a draft of three or four cars. Engineman went to reverse engine to make a back-up movement and twisted his body in such a manner that, with the strain he placed on same when throwing the lever, he sprained the muscles in his back.

1853dd Sheet 34

1. Reading Company.
9. Pennsylvania. 10. Nicetown Junction yard.
17. Operating reverse lever. No defects.
18. Freight shifter, at rest.
24. (a) Thomas M. Clark, 1610 Ruffner Street, Philadelphia. (b) A–148, yard fireman. (c) Back sprained (small). (d) Four days' actual disability.
26. Yard engine 1437 was shifting cars of hogs at the Felin siding when Fireman Clark, who was operating engine at the time, in throwing the reverse lever in some unknown manner sprained his back. No defects in equipment.

Sheet 26

1. Reading Company.
9. Pennsylvania. 10. Rutherford (yd.).
17. Reverse lever, operating. No defect.
18. Extra shifter standing.
[illegible], Harrisburg, Pa. (b) A–144, yard engineman. (c) Sprain, right knee. (d) Eight days' actual disability.
26. Shifting engineman Petrey's duties are to take engines off the job to the ash pit to have fire cleaned and engine inspected, then return engine to the job, etc. He got on engine 1512 to move same for this purpose and when attempting to move reverse lever found it worked stiffly. He stood at front cab door to better operate lever and when pushing the lever back his right foot slipped, resulting in sprain of right knee.

Sheet 31

1. Reading Company.
9. Pennsylvania. 10. Newberry Junction.
17. Operating reverse lever.

18. Switcher train, standing.

24. (a) Robert F. Yarrison, shifting engineman, 430 Germania St., Williamsport, Penna. (b) A–144. (c) Back sprained (small). (e) 42 days' probable disability.

26. Engineman Yarrison claims while he was operating reverse lever in forward motion on engine 1081, he did not get it down far enough to start, and in throwing it back he received a pain in the small of his back, spraining back. No defective condition of engine involved.

1853ee Sheet 27

1. Reading Company.

9. Pennsylvania. 10. Rupert.

17. Operating reverse lever.

18. Extra freight train not moving.

24. (a) Harry A. Lewis, freight engineman, Catawissa, Penna. (b) A–142. (c) Left elbow and shoulder bruised. (e) 60 days probable disability.

26. While Engineman Lewis was operating reverse lever on engine 1535 it went in rear corner hard and in making an effort to get it back it came back suddenly, throwing his elbow back into the brake pipe, striking left shoulder and elbow, bruising same. No defective condition of engine involved.

Sheet 25

1. Reading Company.

9. Pennsylvania. 10. Pipe Street yard, Reading.

17. Operating locomotives. Pulling reverse lever.

18. Freight switcher.

24. (a) Simon Medwig, Reading (Hyde Park), Pa. (b) A–144, shifting engineer. (c) Left side sprained. (d) 13 days actual disability.

26. The above pulling reverse lever on engine felt a sharp pain in his left side and later found he had sprained his side as noted. No defect was found in engine upon examination.

1853ff Sheet 23

1. Reading Co.

9. Penna. 10. Pt. Richmond, yd.

17. Operating reverse lever on engine. No defect.

18. Frt. shifter. At rest.

24. (a) Wm. H. Vellines, Y.M.C.A., Pt. Richmond, Phila. (b) A–144, yd. engineman. (c) Strain of right testicle. (d) 6 days actual disability.

26. The above named in operating the reverse lever of engine 1420 claims to have strained himself due to a sudden jerk. It is evident,

however, that he apparently failed to unlatch the lever and examination failed to disclose any defective condition.

Sheet 12

1. Seaboard Air Line Ry. Co.
9. Fla. 10. Clearwater.
17. Foot caught between reverse lever and boiler head.
18. Passenger. #6, 25 miles per hr.
24. (a) J. A. Rogers, Citrus Park, Fla. (b) A–141. (c) Ankle bruised, left. (d) 4 days actual disability.
26 Accident occurred when Engineer Rogers was attempting to raise reverse lever on engine 814 to get under scheduled speed after stopping at Clearwater and owing to pipe being wet, his foot slipped, catching between boiler head and lever. Although engine was not equipped with safety latch, investigation developed that engineer was aware of this fact and also that safety latch was not a necessary part of engine and merely added as a precaution.

Sheet 16

1. Seaboard Air Line Ry. Co.
9. Fla. 10. Wildwood.
17. Claims reverse lever hard to move.
18. —.
24. (a) G. W. McEvers, Wildwood, Fla. (b) A–128. (c) Sprained back. (e) 15 days probable disability.
26. Hostler McEvers claims while reversing engine 725 he sprained his back, due to reverse lever hard to move. This engine came into Wildwood one day prior to date of this personal injury with no report as to reverse lever and inspection by general foreman does not indicate that condition of engine in any way responsible for this injury.

1853gg

Sheet 14

1. Seaboard Air Line Ry. Co.
9. Florida. 10. West Palm Beach.
17. Was reversing engine and struck his arm against back end of cab.
18. Pass. #192, standing.
24. (a) I. N. Weeks, Waldo, Fla. (b) A–141. (c) Left wrist sprained. (d) 10 days actual disability.
26. At 11:10 p.m., Nov. 9, 1929, train 192, engine 837, West Palm Beach, Fla., while Engineer Week was attempting to reverse engine when picking up a car he struck his arm against the back end of the cab and sprained his left wrist. No defects on engine. Discipline, none.

Sheet 16

1. Seaboard Air Line Ry. Co.
9. N.C. 10. Durham.
17. Foot slipped off feed valve which was being used as a brace.
18. Yard, still.
24. (a) A. J. Spain, Durham, N.C. (b) A–144. (c) Right side wrenched. (e) 30 days probable disability.
26. At 9:30 a.m., Nov. 28, 1929, while reversing engine 1058 in Durham yard, using feed valve to brace himself when his foot slipped off feed valve, resulting in above injury. Discipline, none. No defects on engine.

Sheet 10

1. Seaboard Air Line Ry. Co.
9. S.C. 10. Lobeco.
17. Reverse lever kicked back, account pistons full of steam.
18. Frt. extra #634, 4 miles per hr.
24. (a) L. A. Crosby, Savannah, Ga. (b) A–142. (c) Ligaments in right side sprained. (d) 15 days actual disability.
26. While switching at Lobeco, attempted to reverse engine 634, and in some manner reverse lever kicked back, spraining ligaments in right side. Mechanical inspection and inspection by Engr. Crosby failed to develop any defects in reverse lever and it appears that piston had some steam in it which caused the lever to kick back.

1853hh Sheet 15

1. Seaboard Air Line Ry. Co.
9. Florida. 10. Welcome Junction.
17. Reverse lever sprung back.
18. Pass. #409, 15 miles per hr.
24. (a) L. R. Haven, Plant City, Fla. (b) A–141. (c) Face bruised. (d) 11 days' actual disability.
26. Engineer L. R. Haven in charge of train 409, engine 654, let reverse lever get away, striking him in face. Investigation developed that lever was in extreme front corner and after train started Engineer Haven reached over with one hand to unlatch reverse lever to hook up the engine and holding it with one hand, which was not enough to hold lever, it came back, striking him in face. It was also developed after accident that there were no defects to engine and it is felt accident due to carelessness on part of injured party. Proper report made to Bureau of Locomotive Inspection.

Sheet 40

1. Southern Ry. System, lines east.
9. S.C. 10. Wateree (M.L.)
17. Engineer strained himself while reversing engine.

18. Frt. #71.

24. (a) J. F. Camp, Rock Hill, S.C. (b) A–143; rd. frt. engr. (local & way). (c) Left testicle swollen, very tender over sperm cord. (e) 14 days' probable disability.

26. While local freight no. 71 was performing switching at Wateree, S.C., engineer claimed he strained himself while reversing engine 483. There was nothing defective about the reversing gear which would have contributed to the injury which was due to engineer reversing engine with steam in the steam chest.

Sheet 48

1. Southern Railway System.

9. Tenn. 10. Dayton (M.).

17. Accidental, no defects. See sec. #26.

18. Work. Extra. Still.

24. (a) C. E. Helton, Chattanooga, Tenn. (b) A–143; rd. frt. engr., local. (c) Left elbow bruised. (e) 14 days' probable disability.

26. While work extra 6186, was standing at Dayton, Engr. Helton attempted to reverse engine but his hand slipped off of reverse lever causing his elbow to strike oil pan resulting in his receiving injury mentioned. Inspection of engine after accident occurred by mechanical dept. failed to reveal any defects that would have caused or contributed to injury.

1853ii

Sheet 29

1. Southern Pacific Co.

9. Calif. 10. Mojave.

17. Operating reverse lever of locomotive.

18. Frt. #331. Unknown (speed).

24. (a) Clifford Renshaw, Bakersfield, Calif. (b) Engineer. (c) Bruised left testicle. (e) 30 days probable disability.

26. C. Renshaw, engineer, train 332 leaving Mojave 12:01 p.m., arriving Searles 3:30 p.m., lv. Searles as no. 331, 4:55 p.m., arriving Mojave 7:20 p.m., claims that his clothes caught in reverse lever when reversing engine, bruising his left testicle. Injury appeared to be slight at first but later swelling took place and was necessary for him to report in general hospital for treatment. There were no witnesses to accident, and it was not reported, first report having been received on March 8, 1929. Consist of train 331 shows several interstate shipments. Train 332, none.

Sheet 41

1. Southern Pacific Co., Pacific lines.

9. Calif. 10. Naples.

17. Engineer pinched foot in reverse lever.

18. Frt. Extra, 35 miles per hr.

24. (a) M. H. Culp, 47 MM, in service 9/28/07. (b) Loc. engr. A–142. (c) Bruise of right foot. (d) 8 days actual disability.

26. Engine was drifting about 50% cut off. When approaching Naples engineer unlatched lever to hook up to 25% cut off. The lever, on being unlatched, went over with heavy force and threw engineer off his balance, his foot going down and being caught between lever and boilerhead. Inspection of engine shows that same was in proper working order, and Culp has run an engine for many years and knows that any reverse lever will work hard under these conditions. Was injured on his own responsibility.

Sheet 24

1. Southern Pacific Co., Pacific lines.
9. N.Mex. 10. Tucumcari.
17. Claims injured right groin when foot slipped off pedal ahead of reversing lever on engine.
18. Yard, standing.
24. (a) L. W. Rowland, Tucumcari, N.M. (b) A–148, yard foreman. (c) Injury to right groin. (d) 6 days probable disability.
26. —.

1853jj Sheet 2

1. St. Louis, San Francisco & Texas Ry. Co.
9. Texas. 10. Sherman yds.
17. Fractured wrist reversing locomotive.
18. Frt. extra, standing.
24. (a) J. C. McLain, Ft. Worth, Tex. (b) A–142. (c) Fractured left wrist. (e) 8 weeks' probable disability.
26. Extra north, 706, charge Conductor Martin, Engr. McLain, had arrived at Sherman, Texas, terminal. Engine had been cut off from train and moved out on roundhouse lead track and when engineer placed engine in back motion to back down to roundhouse, he caught forearm between end of reverse lever and back of cab. Engine has standard clearance and in no way defective.

Sheet 34

1. St. Louis-San Francisco Ry. Co.
9. Mo. 10. Billings.
17. Operating reverse lever.
18. Pass. #12, standing.
24. (a) W. B. Stewart, Ft. Smith, Ark. (b) A–145, rd. pass. fireman. (c) Index finger left hand broken between first and second joint. (e) 25 days' probable disability.
26. When no. 12 ready to leave Billings, engineer could not start train due to reverse lever being hard to handle. Fireman went to the assistance of engineer and held to the reverse lever with his

right hand and rested his left hand on the throttle ratchet. This ratchet being of skeleton construction, fireman permitted index finger of left hand to drop inside ratchet. When the engineer opened the throttle, finger caught and bone broken. No defects about the throttle or reverse lever, yet the lever was hard to operate. Stewart an experienced man and familiar with duties.

Sheet 22

1. St. Louis-San Francisco Ry. Co.
9. Mo. 10. Conway.
17. Handling reverse lever.
18. Passenger #12, 40 miles per hr.
24. (a) Martin J. Healey, Springfield, Mo. (b) A–141. (c) Great toe of right foot bruised. (d) 17 days' actual disability.
26. Engineer started to drop reverse lever a couple of notches, so the fireman could sand the flues. Claims the lever jerked him forward and that it struck his right foot, injuring toe. Engine is equipped with a wooden foot brace so placed that it clears the reverse lever. This engineer had his foot on the brace at time injured. Inspection developed there were no defects. All indications are that Healey let the reverse lever get away from him and that he had his foot caught due to it not being in the clear. This engineer has over 40 years service as an engineer.

1853kk

Sheet 14

1. St. Louis, San Francisco Ry. Co.
9. Oklahoma. 10. Muskogee.
17. Engineer operating reverse lever when partially ruptured left side.
18. Freight standing.
24. (a) J. T. May, Muskogee, Okla. (b) A–143. (c) Partial rupture left side. (e) 30 days.
26. Train 755, engine 714, headed west, handling 22 cars, was standing in back rip track Muskegee for purpose of having air tested. When air test was complete and signal given to proceed, engineer in throwing reverse lever from back-up to forward position on account reverse lever being hard to operate, partially ruptured his left side. Engine in good condition. Engineer May experienced engineer, 27 years. Mechanical inspection showed no defects.

Sheet 7

1. St. Louis Southwestern Railway Co.
9. Arkansas. 10. Paragould.
17. Weak spring on reverse lever of locomotive.
18. Yard freight, stopped.

24. (a) J. E. Schackelford, Jonesboro, Ark. (b) A–144. (c) Right knee sprained. (d) 10 days.

26. While handling engine in yard switching movement injured as result of reverse lever on locomotive flying back when throttle opened due to latchet failing to properly seat. Quadrant and latch in good condition except that bolt that holds the reverse lever latch was too tight and spring did not have compression enough to force the latch down into notches of quadrant. An engineer of several yrs. experience, cautioned to watch latch fastening before opening throttle in future.

Sheet 11

1. Terminal R.R. Association of St. Louis.
9. Missouri. 10. St. Louis (yds.).
17. Foot caught between reverse lever and quadrant.
18. Yard, standing.
24. (a) Frank Neil, 2727 Russell, St. Louis, Mo. (b) A–144, engineer. (c) Left great toe bruised. (d) 8 days.

18531l 26. Engine 52 spotted cut of cars for steam at Jefferson Ave. and was given signal to slack pin to cut off engine. Engine was in back motion. Neil had his foot on front end of quadrant & when he took reverse lever out of latch in quadrant it dropped forward very quickly & caught his left foot between reverse lever & foot rest on front end of quadrant, injuring his great toe. He went to St. Mary's Infirmary for treatment. He is 52 yrs. old, married, has been in our employ 12 yrs. Inspection of engine 52 revealed no defective condition of reverse lever, and all safety appliances in good condition and in proper places.

Sheet 17

1. Terminal Railroad Association of St. Louis.
9. Missouri. 10. Bremen Ave.
17. 6316, attempted to push reverse lever over with foot; foot slipped.
18. Yard standing.
24. (a) G. J. Ewersman, St. Louis, Mo. (b) A–129 (hostler). (c) Abrasion, left leg. (d) 6 days.
26. While Hostler Ewersman was attempting to put reverse lever in forward motion, lever being hard to move, he tried to shove it forward with his foot, and his foot slipped between boiler and reverse lever, injuring his left leg.

Sheet 16

1. Texas & New Orleans R.R. Co.
9. Texas. 10. Yougeen.
17. Foot caught between reverse lever and boiler head.

18. Freight moving 30 miles per hour.
24. (a) C. E. Haynes, San Antonio, Texas. (b) Engineer A–142. (c) Left foot bruised at instep. (d) 28 days.
26. Engineman Haynes, when lowering reverse lever, states lever slipped out of his hand, flying forward and catching instep of left foot between reverse lever and boiler head of engine, where he evidently had his foot resting. Thorough inspection made and nothing defective found. Responsibility rests with Engineman Haynes.

1853mm

Sheet 11

1. Texas and New Orleans R.R. Co.
9. Texas. 10. Alice.
17. Stuck ankle against reverse lever.
18. Extra freight moving 6 or 8 miles per hour.
24. (a) R. M. Lowry, Yoakum, Texas. (b) Engineer A–143. (c) Left ankle bruised. (d) 20 days.
26. Working as engineman switching train in Alice yard, Engineer Lowry claims he struck his left ankle against reverse lever, bruising it; however, did not think ankle seriously injured and made no report until his return to Yoakum August 10th. No defects were found on engine 846. Responsibility rests with Engineman Lowry.

Sheet 15

1. Texas & New Orleans R.R. Co.
9. Texas. 10. Dayton track.
17. Bolt in reverse lever latch struck palm of hand, resulting in abscess.
18. Passenger moving 50 miles per hour.
24. (a) R. A. Stulting, Houston, Texas. (b) Engineer A–141. (c) Bruise in palm of left hand, resulting in abscess. (e) 25 days.
26. Had closed throttle preparatory to making station stop. Started to let reverse lever down to half stroke but claims that it jerked out of his hand and went down in corner. Was attempting to lift it back when bolt in bottom of latch struck palm of hand. This engine equipped with Stevenson valve gear and was in good condition. Accident attributable to failure of engineman to exercise proper care in handling reverse lever.

Sheet 45

1. Texas and Pacific Ry. Co.
9. Texas. 10. Toyah.
17. Reverse lever hard to handle and engine riding hard.
18. Freight extra moving 10 miles per hour.
24. (a) J. S. Austin, Big Spring, Texas. (b) A–142. (c) Left side strained. (d) 16 days.

26. This employee, while handling engine 391 near Toyah, in some manner strained his left side. Stated reverse lever hard to handle and engine riding hard.

1853nn Sheet 3

1. Toledo, Peoria & Western R.R.
9. Illinois. 10. Hamilton.
17. Reversing engine.
18. Extra freight.
24. (a) A. F. Merrill. (b) A–143, local freight engineer. (c) Strained left side. (d) 12 days.
26. Operating reverse lever of locomotive, strained left side.

Sheet 9

1. Wabash Ry.
9. Illinois. 10. Adams.
17. Left foot lacerated.
18. Passenger, moving 25 miles per hour.
24. (a) J. R. Adams, Decatur, Ill. (b) A–141. (c) Bruised and lacerated left foot. (e) 25 days.
26. While passenger train 9, engine 664, was en route at Blue Mound, Ill., engineer went to change the cut-off of the reverse lever and it got away from him and went into the corner and caught his foot between boiler head and reverse lever.

Sheet 17

1. Wabash Co.
9. Illinois. 10. Decatur.
17. Fell.
18. Passenger train, moving 3 miles per hour.
24. (a) W. R. Dougherty, Decatur, Ill. (b) A–145. (c) Right side contused. (d) 8 days.
26. While passenger train 2, engine 618, was en route at Decatur, Ill., fireman was assisting engineer pull reverse lever back; foot slipped on ice and snow in cab, causing him to fall, striking his side on end of reverse lever.

1853oo Sheet 10

1. Western Maryland Ry. Co.
9. Maryland. 10. Hagerstown.
17. Claims injured self reversing engine.
18. Freight yard standing.
24. (a) H. E. Miller, Hagerstown, Md. (b) Yd. engr., 144-A. (c) Left knee, inner side, sprain. (d) 5 days.
26. Engineer Miller claims while reversing engine placed left foot against boiler head and when pulled on reverse bar injured self as

above. Engine 733 inspected same date after accident by mechanical department, and no defects found which may have contributed to accident.

Sheet 11

1. Western Pacific R.R. Co.
9. Utah. 10. Wendover.
17. Twisted leg.
18. Freight stopped.
24. (a) N. Kanavan (46) (M) (M), Salt Lake City, Utah. (b) Rd. frt. engr., A–142. (c) Water on right knee. (e) 50 days.
26. The crews of train no. 61 were switching with engine 19 in Wendover yard. Engineer Kanavan alleges that, while reversing the engine from forward to back motion, he sustained the above injury, due to the latches in the reverse lever catching on the notches in the quadrant. This, he further alleges, resulted in a sudden jerk, which caused him to twist his knee as he moved the lever. Kanavan did not make a report of his injury until Sept. 16; and he did not report work on the reverse lever or quadrant at the end of the trip, consequently no inspection of either was made. On Sept. 12 these parts were inspected and were found to be in good condition.

Sheet 12

1. Wheeling and Lake Erie Ry. Co.
9. Ohio. 10. Toledo.
17. Caught arm between reverse lever and cab of engine.
18. Yard standing.
24. (a) Samuel Miller, Harbor View, Ohio. (b) A–144. (c) Fractured right wrist. (c) 30 days.
26. When placing reverse lever in back motion on engine 4307, in order to be able to turn on lubricator, he caught his right arm between the lever and back of cab of engine, causing a fracture to his right wrist.

1853pp

Sheet 28

1. Wheeling and Lake Erie Ry. Co.
9. Ohio. 10. Massillon.
17. Struck elbow on cab of engine.
18. Yard standing.
24. (a) Wm. Repp, 119 6th St., Canton, Ohio. (b) A–144. (c) Left elbow contused. (d) 9 days.
26. While reversing yard engine 4114, engaged in switching service in Columbia yard, east of Massillon, he struck his left elbow on cab of engine.

Sheet 5

1. Wheeling and Lake Erie Ry. Co.
9. Ohio. 10. Harmon.
17. Struck fingers when reversing engine.
18. Freight standing.
24. (a) O. C. Speck, 608 Harriet Ave. Canton, Ohio. (b) A–142. (c) Left third finger sprained. (d) 9 days.
26. Freight train #187, was getting ready to set off sixteen cars on #2 track at Harmon and when attempting to reverse the engine he struck his finger causing a sprain to same.

Sheet 12

1. Yazoo & Miss. Valley R.R. Co.
9. Mississippi. 10. Clarksdale.
17. Reverse lever struck engineer's leg.
18. Sw. yd., moving 4 miles per hour.
24. (a) E. M. Alford (38), Clarksdale, Miss. (b) A–144, yd. engr. (c) Compound fracture left leg. (e) 90 days.
26. While working as engineer shoving 16 cars north drawbar fell out of M. & O. 24461, and as engine passed over same caught on bottom of eccentric link causing reverse lever to fly over striking engineer's left leg, breaking same.

1854 *Statement re exhibit 15*

Exhibit no. 15 is Bulletin No. 240 of the Franklin railway power reverse gear, and is printed under a separate cover. Its reception was limited to the cuts, diagrams, and list of parts.

Statements re exhibits 18 to 28½

Exhibit no. 18 consists of a statement of power reverse gears applied to simple mallets on the B. & O. Railroad. The recapitulation shows that 30 locomotives were equipped with Alco gears at $225, making a total cost of $6,750; 10 locomotives were equipped with the Standard at a cost of $225, making a total of $2,250; 18 locomotives were equipped with Barco gears at a cost of $325, making a total of $5,850; 17 locomotives were equipped with Ragonnet gears but the cost of same is not given. The grand total of the 58 locomotives on which costs are shown amounted to $14,850.

Exhibit no. 19 is a statement of the cost of labor and material
1855 in applying Barco power reverse gears on Mallet locomotives of the B. & O.; cost of steel in reach rod, $1.21, 3½ hours of forging $7.32, 8 hours of machining $6.40; cost of blacksmith and labor to set arm $1.71; cost of machinist to apply reach rod, 36 cents;

total cost of reach rod $17; cost of steel in bracket, $2.87; cost of boilermaker labor to make bracket $16.44, machinist drilling holes, 80 cents; cost of machinist applying bracket and reverse gear $10.96; total cost of power reverse bracket $31.07; total cost of pipe unions, ells, and labor of pipe fitters $12.85; cost of applying bracket and labor, $2.05; cost of labor for making reach rod and applying, $2.74; cost of material for reach rod, $5.40; total cost of applying operating lever and reach rod, $10.19.

Exhibit no. 20 shows the cost of necessary parts for the Ragonnet type A power reverse gear purchased by the B. & O. during a three-year period: 1 front cylinder head, $8.50; six back cylinder heads, $27.60; 5 piston rod gland, $6.50; 6 piston rod gland ring, $4.20; 34 piston rod gland nut, $68; 6 piston rods, $42; 11 crosshead lugs, $85.25; 35 crosshead gibb, $70; 18 combining lever pin and nuts, $18; 89 valve chest gaskets, $22.25; 5 valve stems, $58.75; 4 rocket, $28.48; 5 safety stop set screw and nut, $2.05; 17 hand lever latch guide, $12.75; 8 hand lever latch spring guide, $4; 20 drain cock, $23.20; 1 drain valve thimble, $1; 22 oil cups, $44; 181 J.M. packing cups, $371.05; making a total cost of $897.58.

Exhibit no. 21 is a statement showing the necessary parts of the Ragonnet type B power reverse gear purchased by the B. & O. within the last three years: 2 cylinder, $89.50; 6 cylinder head-
1856 back, $49.80; 7 guide, including front head, $231.21; 4 piston rods with nuts, $41.60; 4 piston rod stuffing box, $22.80; 11 piston rod stuffing box nut, $28.05; 15 crosshead, $144; 14 crosshead arm, $114.80; 3 valve, $14.85; 3 valve chest gland, $9.60; 37 valve chest gasket, $18.50; 5 combination lever, $65; 9 rocker, including trun'ions, $50.85; 10 rocker arm, including bolts, $41; 8 rocker trun-'ion blocks, $2; 16 connecting rod, $19.20; 55 connecting rod and reach rod jaws, $261; 13 reverse gear levers (straight), $81.90; 3 reverse gear levers (offset), $18.90; 11 reverse gear lever quadrant for straight lever, $125.40; 18 reverse lever latch, $16.20; 16 reverse lever latch guide, $30.40; 23 reverse lever latch handle, $47.15; 18 reverse lever latch link, $2.70; 15 reverse lever latch spring, $1.50; 16 reverse lever latch string rod, $9.60; 134 pins, conn rod and reach rod, $241.20; 24 pins, floating lever and reverse lever, $49.20; 33 oil cups (2 per gear), $66; 30 cylinder cocks (2 per gear), $25.50; 116-10″ J.M. packing cups, $261; making a total cost of $2,183.41.

Exhibit no. 22 is a statement showing the necessary parts of type G Alco power reverse gear purchased by the B. & O. within the last three years: 5 type G Also power reverse gear complete, $1,125; 2 cylinder head-back, $14.60; 1 piston rod with nut, $4.80; 1 stuffing box ring, $1; 1 stuffing box gland, $2; 9 crosshead, $143.10; 2 cross-head arm with bushing, $10.80; 3 crosshead keys, $2.70; 1 reverse cylinder valve follower, $1.20; 1 reverse cylinder valve arm, $3.80; 4 floating liner with bushing, $24; 1 floating liner rod, $6.70; 7 rod jaws, $22.33; 6 reversing lever quadrant, $13.20; 6 reverse lever

quadrant support, $20.40; 6 reverse lever latch, $9.00; 6 reverse lever latch guide, $5.70; 6 reverse lever latch handle, $3.60; 10 spring for reverse lever latch handle, $2.40; 6 reverse gear oil cup,
1857 $10.50; 19 reverse gear drain cock, $3.80; 9 rod end for rod to cab, $7.20; 1 reverse lever, style 2, $4.80; 2 reverse cylinder valve comp. with $20 arm, $88; making a total of cost of $1,530.63.

Exhibit no. 23 is a statement of the necessary parts of the Barco type B–4 power reverse gear, purchased by the B. & O., within the last three years: 11 Barco type B–4 power reverse gear comp., $3,575; 2 part R–1 floating lever, $4.90; 1 part Z–2 cup gasket, $2.10, making a total cost of $3,582.

Exhibit no. 24 shows that during the last three years the B. & O. purchased 10 Standard power reverse gears complete at $225 each, costing in all $2,250. It also shows the number and necessary parts of manual screw reverse gears purchased by the B. & O. within the last three years: 35 screw for manual reverse for class P's, Q's, and S locomotives, $405.30; 22 latch handle for screw reverse, $4.62; 6 handle for screw reverse gear, Line 1, for Q4–B locomotives, $2.76, making a total cost of $412.68.

1858 Exhibit no. 25 consists of two sheets showing locomotive inspection reports on C. & N. W. engine 3005. The reports are dated May 20, 1931, at Clinton, Iowa. On the first sheet under "repairs needed" it shows left valve gear broken, left valve head broken, release gear in bad order, jumps over badly at times; signed H. Williams, engineer. The valve head and valve gear were repaired and under note of repairs made it shows—turned power reverse piston, new cylinder backing, new piston backing, new rotary valve; signed Lawler. Sheet 2 of this exhibit shows that the safety valve lifts at 250, safety valve sets at 248, and pyrometer 450–500; main reservoir pressure running 100 lap 145; brake pipe pressure 70; driver piston travel 4, tender piston travel 5, left stem valve packing reported, leakage known, other conditions reported good. Under "repairs needed" it shows valve gear badly broken and left valve head broken, air reverse pumps and gear bad, blower valve don't open far enough, signed E. J. Cole, engineer. The respective repairs are shown as having been made, signed by Doyle, Lawler, and Hooker.

Exhibits nos. 26 and 27 are eliminated by stipulation (R. —).

Exhibit no. 28. (See next sheet attached.)

Exhibit 28½ is a cut and picture of the Barco power reverse gear. Sheet 2 shows engineer's quadrant lever in the cab, diagram RG–1122; and also the reach rod lever arm, cylinder ports, valve seat, floating lever, floating link and reach rod lever arm under RG–1129. Sheet 3 shows pinion worms, worm gear, worm gear shaft, pistons, cylinder walls and rectangular rack under RG–1091. Sheet 4 is a diagram of the general arrangement of the Barco power reverse gear showing the names of all the parts and dimensions.

1859 *Exhibit no. 28*

VALVE & REVERSE GEAR EQUIPMENT

Class	No. in class	Weight on drivers	Type of valve gear	Kind of reverse gear
A	15	83,300 lbs.	Stephenson	Hand.
B	2	94,900 "	Stephenson	Hand.
C	2	85,700 "	Stephenson	Hand.
C-5	12	61,600 "	Stephenson	Hand.
D	75	92,500 "	Stephenson	Hand.
D	15	97,500 "	Walschaert	Hand.
E	40	154,000 "	Walschaert	Hand.
E	40	154,500 "	Walschaert	Hand.
E	1	163,000 "	Baker	Hand.
E	29	163,000 "	Baker	Alco.
E	18	164,500 "	Baker	Hand.
E	19	168,500 "	Young	Hand.
E	20	174,000 "	Young	Alco.
E-1	15	134,500 "	Walschaert	Alco.
E-1	20	138,500 "	Baker	Hand.
E-1	6	139,000 "	Baker	Hand.
E-2	12	175,500 "	Walschaert	Hand.
E	5	288,000 "	Baker	Barco.
H	30	288,000 "	Walschaert	Alco.
J	34	229,500 "	Baker	Alco.
J	21	229,500 "	Baker	Alco.
J	1	229,500 "	Baker	Ragonnet.
J	114	229,500 "	Baker	Barco.
J	1	229,500 "	Baker	Ragonnet
J	21	229,500 "	Baker	Barco.
J	40	233,000 "	Young	Ragonnet.
J	65	233,000 "	Young	Alco.
J	13	234,500 "	Young	Barco.
J-4	12	253,500 "	Walschaert	Barco.
L	20	112,000 "	Walschaert	Barco.
M	34	106,800 "	Stephenson	Hand.
M-1	33	121,000 "	Stephenson	Hand.
M-1	36	124,000 "	Stephenson	Hand.
M-1	32	130,500 "	Baker	Hand.
M-1	90	140,500 "	Baker	Hand.
M-2	40	184,000 "	Baker	Hand.
M-2	35	174,500 "	Baker	Alco.
M-3	35	163,500 "	Baker	Ragonnet.
M-4	8	231,000 "	Baker	Alco.
Q	13	108,575 "	Stephenson	Alco.
R	105	121,750 "	Stephenson	Hand.
R-1	37	136,500 "	Walschaert	Hand.
R-1	268	127,500 "	Stephenson	Hand.
R-1	3	139,000 "	Walschaert	Hand.
R-1	16	130,000 "	Stephenson	Hand.
S-2	18	102,575 "	Stephenson	Hand.
S-4	27	102,550 "	Stephenson	Hand.
Z	37	209,500 "	Walschaert	Alco.
Z	3	209,500 "	Walschaert	Barco.
Z	156	209,500 "	Walschaert	Alco.
Z	10	209,500 "	Walschaert	Barco.
Z	45	214,500 "	Baker	Barco.

Statements re exhibits 29 to 35

1860 Exhibit no. 29 consists of five charts concerning the C., R. I. & P. showing days worked per month from a high of 27 during October 1928 to a low of no days worked during August 1930. Chart 2 is a graph concerning the number of locomotives given general repairs per month ranging from a high of 58 during May 1929 to a low of 8 during August 1930. Chart 3 is a graph showing the average mileage made by engines before repairs ranging from a low of 52,000 miles during April 1928 to a high of 83,000 during May 1931. Chart 4 is a graph of the number of men employed showing the range from a high of 6,847 during November 1928 to a low of 4,153 during August 1930. Chart 5 is a graph showing the

labor expenses starting with a cost of $950,000 during January 1928 and reaching a peak of $1,126,962 during April 1929 and a low of $592,451 during August 1930 and ending with a cost of $633,300 during April 1931.

Exhibit no. 30 is an income account of the Rock Island lines for the five years ending December 31, 1930, and four months ending April 30, 1931. Total railway operating revenues: 1926, $137,911,-415.30; 1927, $140,086,990.58; 1928, $141,232,603.95; 1929, $147,721,-562.36; 1930, $123,079,909.82; 4 months ending April 30, 1931, $33,-448,396.44. Railway operating income: 1926, $27,539,860.42; 1927, $28,773,936.27; 1928, $29,513,204.46; 1929, $30,921,693.86; 1930, $25,-296,877.71; 4 months ending Apr 30, 1931, $5,480,271.47. Gross income including nonoperating income: 1926, $29,498,308.27; 1927; $31,151,767.23; 1928, $31,689,705.04; 1929, $33,443,844.95; 1930, $27,-857,790.57; 4 months ending April 30, 1931, $6,296,829.46. Net income: 1926, $11,515,881.48; 1927, $12,564,830.31; 1928, $13,167,696.37; 1929, $14,007,320.87; 1930, $7,700,228.73; 4 months ending April 30, 1931 (deficit), $467,571.47.

Exhibit no. 31 is a statement showing the net income or deficit of the Rock Island lines for the four months ending
1861 April 30 during the years 1926 to 1931, inclusive: 1926, deficit, $578,080; 1927, $2,168,432; 1928, $2,544,596; 1929, $2,331,233; 1930, $952,030; 1931, deficit, $467,571.

Exhibit no. 32 is a statement showing property investment, net railway operating income, and rate of return of Rock Island lines for the years ending December 31, 1923 to 1930, inclusive, to wit:

Years	Property investment	Net railway operating income	Rate of return
1923	$420,279,208.30	$14,841,165.61	3.53
1924	425,768,467.31	17,713,589.96	4.16
1925	435,215,706.35	17,926,384.10	4.12
1926	443,934,858.58	22,358,128.92	5.04
1927	460,025,284.67	23,436,722.89	5.09
1928	468,197,932.41	24,266,515.14	5.18
1929	486,512,663.59	24,848,908.75	5.11
1930	514,019,067.64	19,747,806.57	3.84

1862 Exhibit no. 33 shows certain traffic statistics of the Rock Island lines for the years ending December 31, 1926 to 1930, inclusive, and four months ending April 30, 1931. During 1926, 8,316,546 revenue tons were carried one mile and 792,066,316 passengers were carried one mile; during 1927, 8,589,546,367 revenue tons were carried one mile which was 3.28 percent over 1926, and 764,143,-553 passengers were carried one mile which was 3.50 percent under 1926; during 1928, 9,178,453,177 revenue tons were carried one mile which was 10.36 over 1926, and 688,730,066 passengers were carried one mile which was 13.05 under 1926; during 1929, 9,917,562,335 revenue tons were carried one mile which was 19.25 over 1926, and 682,-789,510 passengers carried one mile which was 13.8 under 1926; and during 1930, 8,481,810,873 revenue tons were carried one mile which was 1.99 over 1926, and 562,543,645 passengers carried one mile

which was 28.98 in 1926. During the three months ending March 31, 1931, 1,772,022,112 revenue tons were carried one mile and for the first four months of 1931, 145,942,289 passengers were carried one mile.

Exhibit no. 34 is a statement showing the number of employees on the Rock Island lines by classes at March 15, June 15, September 15, and December 15; the average number during the years 1926 to 1930, inclusive, and the percent of increase or decrease over or under the year 1926. Also the number of employees at March 15, 1931.

The pertinent statistics from this exhibit are as follows:

1863

Exhibit no. 34

EXECUTIVES, OFFICIALS, AND STAFF ASSISTANTS

Counted at	1926	1927	1928	1929	1930	1931
March 15th	346	346	352	333	326	309
Average	345	352	336	328	322	
Percent		I 2.03	D 2.61	D 4.93	D 6.67	

PROFESSIONAL, CLERICAL AND GENERAL

March 15th	5,608	5,833	5,733	5,831	5,802	5,108
Average	5,663	5,850	5,781	5,879	5,593	
Percent		I 3.30	I 2.08	I 3.81	D 1.24	

MAINTENANCE OF WAY AND STRUCTURES

March 15th	7,253	8,468	7,390	8,572	7,655	6,647
Average	8,649	10,074	9,561	10,212	8,623	
Percent		I 16.48	I 10.54	I 18.07	D .30	

MAINTENANCE OF EQUIPMENT AND STORES

March 15th	12,043	11,426	10,194	10,698	8,442	7,057
Average	11,929	11,480	10,449	10,635	8,114	
Percent		D 3.76	D 12.41	D 10.85	D 31.98	

TRANSPORTATION (OTHER THAN TRAIN, ENGINE, AND YARD)

March 15th	3,991	4,030	3,891	4,220	4,068	3,501
Average	4,008	4,039	3,959	4,201	3,900	
Percent		I .77	D 1.22	I 4.81	D 2.69	

YARDMASTERS, SWITCH TENDERS, AND HOSTLERS

March 15th	352	340	324	333	319	274
Average	347	341	330	334	309	
Percent		D 1.82	D 4.90	D 4.75	D 10.95	

TRAIN AND ENGINE SERVICE

March *	6,102	6,660	6,291	6,470	5,971	4,978
Average	6,329	6,516	6,484	6,520	5,639	
Percent		I 2.95	I 2.45	I 3.02	D 9.90	
Average	37,270	38,652	36,900	38,109	32,500	
Percent		I 3.71	D .99	I 2.25	D 12.80	

I=Denotes increase. D=Denotes decrease.

*Average of count on employees at 7th, 15th, 22nd, and 28th of month.

1864 Exhibit no. 35 is a statement concerning certain mechanical defects found in certain locomotives of the C. & N. W., the repairs that were made, the cost of material and labor in repairing same. The last general overhauling of the Barco reverse gears on the Wisconsin division is as follows: Engine 2902, July 1930; engine 2905, June 1930; engine 2909, August 1929; engine 2910, August 1930; engine 2911, December 1929. The cost of the parts which were actually renewed where gears are fully overhauled is: Valve, $6; rack piston, $24.82; post or stem key, $1.35. The amount of labor required will average from $12 to $15. Engine 2905, reported by Engineer Custer, reverse gear creeps, 10–19–30, cost of labor in repairing, 69 cents; engine 2911, reported by Engineer Tinkham, "power reverse gear does not hold valve gear in place", 12–28–30, cost of labor in making adjustment, $1.42; engine 2911, reported by Engineer Sorber, "air reverse works hard", 12–27–30, cost of labor in adjusting, 69 cents; engine 2911, reported by Engineer Miller, 10–30–30, "air reverse operates too slow", labor cost of adjusting, $1.37; engine 2911, reported by Engineer Dooley, 10–13–30, "take up lost motion in power reverse gear", labor cost $2.06; engine 2905, reported by Engineer E. O. Miller, 11–8–30, "air reverse does not respond as well as it should to movement of reverse lever", labor cost, $2.74; engine 2911, reported by Engineer Miller, 11–18–30, "lengthen reach rod for air reverse", labor cost, $2.74; engine 2911, reported by Engineer Steffen, 11–3–30, "air reverse pulls hard, also lose control", labor cost, 69 cents; engine 2910, reported by Engineer Ensfield, 2–17–31, "reverse lever creeps", labor cost, $3.43; engine 2910, reported by Engineer Ensfield, 2–13–31, "reverse lever creeps", labor cost, $0.69; engine 2910, reported by Engineer Whitlaw,
1865 2–15–31, "air reverse gear creeps badly", labor cost, $0.69; engine 3910, reported by Engineer James, 2–1–31, "reverse gear creeps badly", labor cost, $2.06; engine 2910, reported by Engineer Wheeler, 2–9–31, "air reverse creeps badly. Engine is hard on coal account not being able to work in proper cut-off", labor cost, $2.74; engine 2910, reported by Engineer James, 2–2–31, "reverse gear is creeping all the time", labor cost, 69 cents; engine 2910, reported by Engineer Miller, 2–4–31, "reverse gear creeps", labor cost, $4.80; engine 2910, reported by Engineer James, 2–7–31, "reverse gear creeps badly and engine cannot make the time with reverse gear in the condition it is in, worst I have found on any engine", labor cost, $4.11; engine 2910, reported by Engineer Sanborn, 2–15–31, "reverse gear creeps badly", labor cost, $2.74; engine 2905, reported by Engineer Light, 1–21–31, "air reverse creeps", labor cost, $1.03; engine 2911, reported by Engineer Barrett, 1–18–31, "valve gear creeps", cost of labor, 71 cents; engine 2909, reported by Engineer Crider, "reverse gear does not operate properly", 1–21–31, cost of labor, $5.48; engine 2909, reported by Engineer Crider, 1–20–31, "examine reverse gear creeps", cost of labor, 71

cents; engine 2909, reported by Engineer Leper, 1–6–31, "air reverse lever creeps", labor cost, $5.48; engine 2541, reported by Engineer Pfeiffer, 10–28–30, "power reverse gear creeps when hooked up high", labor cost, 69 cents; engine 2541, reported by Engineer Custer, 11–1–30, "power reverse gear creeps", cost of labor, $2.84; engine 2541, reported by Engineer Davey, 11–3–30, "reverse gear creeps", labor cost, $1.37; engine 2541, reported by Engineer Ensfield, 10–10–30, "reverse lever creeps very bad when hooked up high", labor cost, $1.37; engine 2542, reported by Engineer Ensfield, 10–16–30, "reverse gear creeps very bad when engine is hooked up high", labor cost, $1.37.

1866 In addition to the above, there were a number of reports turned in verbally by the road foremen of engines to the general foreman which we do not have a record of. Also notes sent down by the road foreman from the Madison division, of which we do not have a record.

The reason engines 2902 and 2903 do not appear in the report is that engine 2902 was loaned to the C., St. P., M. & O. during the period of this checking and after being returned to Chicago was tied up servi ble at Chicago shops. The reason engine 2903 does not appear on this report is that this engine was in the shop undergoing 3e repairs.

We do not have a record of material used in making these running repairs.

Exhibit 36

Exhibit no. 36 is a letter to Mr. Frank McManamy, chief inspector I.C.C., Washington, D.C., dated Jersey City, N.J., October 18, 1916, and signed by Wm. A. McKeoun, inspector, reading as follows:

In reply to your message dated Oct. 14th, I have investigated an accident caused by locomotive no. 356 owned and operated by the New York, Ontario and Western Railroad, at Middletown, N.Y., on Oct. 14th, 15th, and 16th, and reported as follows:

Nature of accident

Steam getting by throttle into cylinders causing locomotive to move.

Time and place of accident

3 p.m. Friday, Oct. 13th, 1916, at Middletown, N.Y.

Personal injuries

Diego Amelis, laborer, right leg amputated just above knee, taken to Thrall Hospital, Middletown, N.Y.

Domenick Triponi, laborer, killed.

Edward Schoonmaker, mason, right leg crushed, taken to Thrall Hospital, Middletown, N.Y.

1867 Names and addresses of injured

Diego Amelis, 24 Prince Street, Middletown, N.Y.
Domenick Triponi, 66 Cottage Street, " "
Edward Schoonmaker, Kerhonkson, N.Y.

Description of accident

Locomotive no. 356, type 2–10–2, superheated, had just received a general overhauling and had been taken from the erecting shop, and placed on a track, just outside the shop, to be fired up and tested under steam. Locomotive was fired up about 11 a.m., at 3 p.m., locomotive had sufficient steam to adjust the safety valves, which were being adjusted by a man on top of the boiler to pop at 190 and 194 lb. One valve had just started to release at 194 lb. when the locomotive started to move. Ira C. Wallace, traveling fireman, who was in the cab of the locomotive noticed the engine moving and tried to reverse the locomotive, as this locomotive is reversed by air, and the air pump having just been started prior to the locomotive moving, there was not sufficient air to operate the reversing gear or air-brakes, so the locomotive continued down the track entering the erecting shop and pushing open the doors striking a tender no. 361 which was on the same track in the erecting shop. Mr. M. Weber, foreman of masons in the roadway dept. and a number of men had been working on a building adjoining the erecting shop. It had started to rain and the men to get out of the wet had gone into the erecting shop and were sitting down on both sides of the track near the doors (which were closed) at the opposite side of the shop for which doors the locomotive was heading. Several of the men seeing the locomotive entering the shop with steam blowing from the safety valves, stepped to one side to let the locomotive go by. Diego Amelis, Domenick Tuponi, and Edward Schoonmaker got up and endeavored to open the doors either to let the locomotive out or to get out themselves and the tender which the locomotive was pushing ahead of it, came up against the doors, forcing the doors open and catching the men, killing one and injuring the other two as above mentioned. Peter J. Schaefer who was one of the masons employed on the building witnessed the accident, informed me that when the three men who were injured saw the locomotive enter the shop, they got up and endeavored to open the doors and were caught by the tender. The following men were working about the engine prior to the locomotive starting:

Ira C. Wallace, traveling fireman.
Peter Kelver, pipe man.
*The above were in the cab.
John E. Dundon was adjusting safety valves on top of boiler.

Leo Cressy, air-brake foreman, was on the ground and directing the man that was adjusting the safety valves. He had just got off the locomotive after looking at the steam gauge which registered 194 lb. when the safety valves opened up and the locomotive started to move. All the men working about the engine informed me as far as they knew the throttle was shut off and had not been tampered with and could give no reason for the locomotive moving.

1868 Examination of locomotive

On my arrival at the New York, Ontario and Western Railroad shops, at Middletown, N.Y., Oct. 14th, 1916. I found locomotive no. 356 in erecting shop, with the fire out. I found but very little damage had been done to the locomotive. The throttle was shut off and all four cylinder cocks disconnected, which as I was told were disconnected prior to the locomotive being fired up to allow the steam to escape from the cylinders, should any accumulate there. I examined the throttle lever quadrant and found that a small stud which acted as a stop for the lever had been cut off. This stop had been cut off after the accident occurred so as to allow the throttle lever to be thrown farther ahead. I requested the boiler to be fired up and had the throttle lever set on a line with the stop which had been cut off the quadrant. All the time the locomotive was making steam, water and steam was escaping from cylinder cocks. When steam gauge showed 150 lb. pressure, locomotive started to move due to the throttle not being closed. By moving the throttle lever ahead and passed this stud which had been cut off, the throttle seated and prevented the steam from escaping into the cylinders.

Cause of accident

Due to steam getting by throttle valve into cylinders causing locomotive to move and no means provided for stopping it.

Yours very truly,

S/ Wm. A. McKeoun,
Inspector.

Note.—This locomotive equipped with Chambers throttle.

Exhibit no. 37 is a statement concerning locomotives not equipped with power reverse gears on the Bangor and Aroostook Railroad as follows:

1869 *Exhibit No. 37*

BANGOR AND AROOSTOOK RAILROAD COMPANY, DATA RE LOCOMOTIVES NOT EQUIPPED WITH POWER REVERSE GEAR

Engine number	R.R. class	Wythe symbol	Year built	Weight on drivers	Tractive power	Cost, new	Cost, less depreciation 1-13-1	Mileage, 1929	Mileage, 1930	Due for classified repairs	Cost to apply power reverse gear
51	D-1	4-6-0	1901	111,875	25,380	$13,976.22	$6,009.41	12,910	14,844	July 1931	$425.00
53	D-1	4-6-0	1901	111,875	25,380	14,057.34	6,107.93	20,603	35,083	Jan. 1932	"
54	D-1	4-6-0	1901	111,875	25,380	13,997.54	5,919.83	10,923	16,032	Mar. 1933	"
55	D-1	4-6-0	1902	111,875	25,380	14,981.18	6,508.18	7,403	10,819	Aug. 1932	"
56	D-1	4-6-0	1902	111,875	25,380	14,974.67	6,500.56	14,700	10,297	Aug. 1932	"
58	D-1	4-6-0	1902	111,875	25,380	14,986.46	6,534.26	26,882	30,461	Feb. 1934	"
59	D-1	4-6-0	1902	111,875	25,380	14,986.29	6,538.05	14,491	12,775	Dec. 1932	"
60	D-1	4-6-0	1901	111,875	25,380	13,977.32	5,922.16	11,741	10,069	Mar. 1933	"
61	D-1	4-6-0	1901	111,875	25,380	13,994.13	5,939.94	13,114	9,822	Jan. 1933	"
62	D-1	4-6-0	1901	111,875	25,380	13,993.37	5,940.67	9,117	7,966	March 1935	"
65	D-1	4-6-0	1905	111,875	25,380	13,534.36	6,699.46	3,682	6,327	Jan. 1933	"
66	D-1	4-6-0	1905	111,875	25,380	13,515.33	6,678.45	13,638	12,375	May 1932	"
67	D-1	4-6-0	1905	111,875	25,380	13,577.28	6,751.38	11,101	13,754	Apr. 1932	"
68	D-1	4-6-0	1905	111,875	25,380	13,529.75	6,711.86	15,801	8,910	Jan. 1934	"
69	D-1	4-6-0	1905	111,875	25,380	13,623.36	6,820.66	6,023	15,634	July 1931	"
70	D-1	4-6-0	1905	111,875	25,380	13,501.75	6,729.53	14,460	5,470	Aug. 1934	"
71	D-1	4-6-0	1905	111,875	25,380	13,739.15	7,259.51	100	15,084	May 1932	"
73	D-1	4-6-0	1905	111,875	25,380	13,579.35	6,878.09	9,173	11,277	Sept. 1932	"
75	D-1	406-0	1905	111,875	25,380	13,493.31	6,823.19	17,895	9,354	June 1932	"
77	D-1	4-6-0	1906	111,875	25,380	13,799.22	7,291.40	3,637	6,127	At present	"
82	D-1	4-6-0	1907	112,000	25,380	15,170.34	8,209.92	8,491	10,260	Sept. 1931	"
83	D-2	4-6-0	1907	112,000	25,380	15,357.15	8,375.28	15,021	4,003	Oct. 1932	"
84	D-2	4-6-0	1907	112,000	25,380	15,212.35	8,229.16	12,041	11,480	Nov. 1931	"
85	D-2	4-6-0	1907	112,000	25,380	15,407.17	8,406.89	11,547	6,607	Dec. 1931	"
86	D-2	4-6-0	1907	112,000	25,380	15,168.77	8,196.80	7,344	15,436	June 1931	"
87	D-2	4-6-0	1907	112,000	25,380	15,153.89	8,183.06	8,618	7,213	Nov. 1932	"
93 [1]	D-3	4-6-0	1911	127,600	28,200	17,017.29	10,727.54	21,845	18,893	July 1933	"
204	H-2	4-4-0	1893	58,800	12,165	7,962.51	2,694.71	15,114	29,507	Jan. 1932	"
206 [1]	H-3	4-4-0	1893	49,800	12,450	8,019.61	2,282.64	9,836	------	At present	"
207	H-2	4-4-0	1894	58,800	12,166	8,184.50	2,964.77	13,334	28,994	Mar. 1934	"
210	K	4-4-0	1893	64,600	16,800	7,842.15	2,144.77	18,347	22,307	Feb. 1934	"
212	K	4-4-0	1893	64,600	16,800	8,070.68	2,330.93	17,943	10,340	Oct. 1933	"
213	K	4-4-0	1893	64,600	16,800	8,070.52	2,401.54	28,059	22,602	Oct. 1932	"
242 [1]	C-1	4-6-0	1902	113,000	22,000	15,535.95	6,937.17	42,110	24,540	June 1933	"
243 [1]	C-1	4-6-0	1907	117,800	24,340	17,595.70	10,794.81	44,675	42,567	Aug. 1934	"
320 [1]	P	0-6-0	1905	131,000	28,080	11,584.34	5,728.12	21,524	10,822	Apr. 1932	"

[1] Programmed for power reverse gear at next classified repairs.
[2] Permanently out of service.
[3] If this engine rebuilt to match engine 243 power reverse gear will be applied.

1870 NOTE.—Numbers above include all locomotives of RR class shown except classes D-3 and P.

Statements re exhibits 38 to 49

Exhibit no. 38 is a statement of F. Stone at Mexico, Mo., January 19, 1931. I reside at Mexico, am employed by the C. & A. R.R. as engineer, and was engineer of train 216 on December 8, 1930. About a mile north of Fulton reverse gear latch became unlatched dropping from center of quadrant to forward stop on quadrant and heel was caught between reverse lever and stop on quadrant. There was nobody to blame for this accident which would have been avoided if I had properly inserted reverse lever latch in quadrant. No defects in engine. I have read above statement and it is true. Signed, F. Stone.

Exhibit no. 39 is a standard form of the C. & A. R.R. Company report of accidents to persons or vehicles. Mexico, Mo., December 15, 1930, to D. H. Deasy, supt.; date of accident, December 8th, north of Fulton, 2:30 p.m., out of city limits; weather clear; train no. 216, engine no. 357, Conductor D. M. Edwards, Engineer F. Stone, Fireman F. L. Strauss, Brakemen Hogan, Thomas, and

Stewart. Injured person taken to Mexico; Conductor Edwards called Conductor Rodes; trainmen were at their posts; speed of train 20 miles per hour; engineer and fireman were looking out of cab. At point of accident the track was straight and the train was moving ahead. The engine was carefully handled and there was no reason to suspect that the party injured had been drinking intoxicating liquor.

1871 Cause of accident—Reverse lever latch becoming unlatched, dropping from center of quadrant to forward stop of quadrant, catching heel of left foot. There was no defective parts to the locomotive. Cause of the accident was failing to properly insert reverse lever latch in quadrant. The names of the witnesses to the accident are Brakeman Hogan and Fireman F. L. Strauss. There was no apparent defects on the engine.

Exhibit no. 40 is a picture of a head-on collision of 2 locomotives, showing Sou. Pac. engine 3313 very badly wrecked. The cylinder on the right side of this locomotive is torn clear off the engine, the front end of the boiler jammed into the front of the other locomotive, and the cab jammed back into the tender.

Exhibit no. 41 is a synopsis and summary of answers of 232 short-line railroads to questionnaires relating to operating and financial conditions, and is transmitted in its entirety as an original exhibit.

Exhibit no. 42 is a statement of the net railway operating income or deficit of the Eureka-Nevada Railway Company for the five years 1926 to 1930, inclusive:

	1926	1927	1928	1929	1930
Railway operating revenues	$130,007	$75,551	$63,319	$71,047	$42,566
Railway operating expenses	107,135	86,407	62,077	67,427	54,384
Net revenue (or deficit) from railway operations	22,872	d 10,855	1,242	3,620	d 11,818
Railway tax accruals	7,000	4,588	4,828	3,937	3,952
Railway operating income or deficit	15,872	d 15,443	d 3,586	d 317	d 15,770
Deductions:					
Hire of freight cars		239			
Rent of locomotives		1,380			
Net railway operating Income or deficit	15,872	d 17,062 (1)	d 3,586	d 317 (2)	d 15,770

d=Deficit.

[1] In 1917 we had a disastrous fire which destroyed considerable equipment and we had to rent some locomotives for a few months.

[2] In 1929 we received $9,414.00 back mail pay which is included in the revenues for 1927 but was earned previously so in reality for that year we lost nearly $10,000.

1872 Exhibit 43 is a statement showing locomotive miles on the Eureka-Nevada Railway for the years 1926 to 1930, inclusive, with percentages as compared to 1926. Also statement showing gasoline motor miles for the same period with percentages of increase as compared with 1926. The gasoline motor miles increased 600 percent. This road purchased $15,394 in coal during 1926, $11,603 in 1927, $7,349 in 1928, and $7,583 in 1929, and $48,313 in 1930.

Year	Locomotive miles	Comparison with 1926	Locomotive miles		
			Period	Year	
				1930	1931
		Percent			
1926	52,116	100.0	Jan. 1 to May 31	8,484	3,598
1927	31,770	60.9	Percent	100.0	42.4
1928	24,480	47.0			
1929	20,812	39.9			
1930	14,755	28.3			

Thus showing a decrease in the five years 71.7%.

Exhibit No. 44

Number of locomotives in service, three

No. of locomotives	Type	Weight on drivers	Length of fire-box	Steam pressure	Driving wheel diameter	Size of cyls.
7	Mogul	34,000	42"	160	36 inches	11x16
10	Consol	55,000	78¾"	160	36 "	14x18
11	Consol	59,000	78"	170	33 "	14x18

Exhibit No. 45

Statement showing number of tons of revenue freight handled by years from 1926 to 1930, inclusive

Year	1926	1927	1928	1929	1930
Tons	23,723	13,765	10,239	9,277	4,797
Comparison with 1926, percent	100.0	58.0	43.2	39.1	20.2

Showing a loss in tons of revenue freight of 79.8 percent in the five-year period.

1873 *Statement showing number of revenue passengers carried in the years 1926 to 1930, inclusive*

Year	1926	1927	1928	1929	1930
No. of passengers	1,221	641	456	417	242
Comparison with 1926, percent	100.0	52.5	37.4	34.1	19.8

Showing a loss of revenue passengers carried during the five-year period of 80.2 percent.

Exhibit no. 46 is a copy of the rules and regulations of the operating department of the Belfast and Moose Head Lake Railway Company.

Exhibit no. 47 is a statement of locomotive data of the Belfast and Moose Head Lake Railroad. It also shows constructive statement of coal consumption in both freight and passenger service for the month of March 1931. It also shows the net income for this railroad

in 1926 to be $1,450.67, a deficit of $9,035.02; 1928, net income, $5,379.77; 1929, net income, $2,462.79; and 1930, net income, $11,576.36. It also shows that during 1929 locomotive miles averaged 67.4 miles per locomotive and in 1930, 68.1 miles. The net ton-miles per locomotive day were 7,719 in 1929 and 7,573 in 1930.

Exhibit no. 48 is a photograph of the six-coupled 2–6–2 type tank locomotive constructed by Baldwin for the Berlin Mills Railway.

Exhibit no. 49 is a statement which further amplifies the accident reports (form T) made to the bureau of statistics as shown on exhibit no. 13. Injuries reported: Sheet 72, B. & O., T. C. Bollard, 3–26–1929; sheet 102, Erie, E. V. Jolley, 10–12–29; and sheet 180, P. R.R., M. J. Prinz, 9–4–29, occurred on locomotives 1874 equipped with hand screw reverse gears. Injuries reported on sheet 16, B. & A., J. Gordon, 10–11–30 (Franklin Precision, type F); sheet 35, C. & N. W., H. E. Blowers, 5–15–29 (Alco, type E); sheet 94, D., L. & W., A. G. Miller, 10–27–29 (Alco, type G–1); sheet 97, D. & R. G. W., F. G. Rupp, 3–3–29 (Mellin); sheet 113, I.C., N. E. Chadwick, 5–29–29 (Ragonnet, type A); sheet 118, K. O. & G., H. V. Cook, 7–5–30 (Barco); sheet 123, L. V., F. Ringlet, 10–30–30 (Franklin Railway Supply Co., type A–7); sheet 136, M. V., G. Friend 7–17–30 (unnamed); sheet 147, N.Y.C., W. V. Ryan, 4–9–29 (Franklin Precision, type F); sheet 150, N.Y.C., R. McDonold, 10–20–30 (Franklin Precision, type F); sheet 162, N. C. & St. L., W. S. Hailey, 5–13–30 (Ragonnet, type A); and sheet 176, N. & W., C. H. McDaniel, 9–15–29 (Franklin Precision); occurred on locomotives equipped with power reverse gears of the kind shown above in parentheses, and all of the remaining reports relate to injuries received from hand reverse levers.

1875–1877

Exhibit 53

Exhibit no. 53 is a tabulation of total casualties, reverse gear casualties, and percent of reverse gear cases of total for the five-year period 1925 to 1929, inclusive.

ENGINEERS

Year	All casualties		Reverse gear casualties		Percent
	K.	I.	K.	I.	
1925	90	2,560	----------	255	9.6
1926	73	2,754	----------	257	9.1
1927	73	2,095	----------	193	8.9
1928	63	1,807	----------	143	7.6
1929	71	1,579	----------	129	7.8

FIREMEN

1925	75	4,777	----------	30	0.6
1926	71	4,853	----------	29	0.6
1927	82	3,785	----------	33	0.8
1928	50	2,908	----------	25	0.8
1929	70	2,725	----------	22	0.8

NOTE.—Tabulated from I.C.C. annual statistics.

Exhibit 54

Exhibit no. 54 is a tabulation of the total casualties to engineers and firemen on the Union Pacific System and the reverse gear casualties for the five years 1926 to 1930, inclusive.

Engineers and firemen

Engineers and Firemen			
Year	All casualties	Reverse gear casualties	Per cent of engines with hand reverse
1926	34		62
1927	23	1	55
1928	26		55
1929	17		45
1930	14		42
Total	114	1	

Estimated cost to equip balance of engines with power reverse gear $333,262.00

1878

Exhibit 55

Exhibit no. 55 is a statement showing the cost of maintenance of various types of reverse gears, including labor and material expended to maintain such gears in serviceable condition, for a 1-year period on the Union Pacific System.

7" Ragonnet	$68.04
9" Ragonnet	70.58
10" Ragonnet	67.64
Alco	66.60
Precision	68.04
Hand reverse	5.00

Exhibit 56

Exhibit no. 56 shows maintenance difficulties and is a survey of work reports for Council Bluffs Terminal for month of March, 1931.

Engine dispatched				Defects reported		
Terminal	Hand reverse	Power reverse	Screw reverse	Hand reverse	Power reverse	Screw reverse
Co. Bluffs, Iowa	301	1,837	None	4	142	None

Power reverse, defects classified

Piston packing	63
Rod packing	10
Creeping	34
Valve	5

Power reverse, defects classified—Continued

Gear loose	
On bracket	5
Gasket leaking	1
Bracket loose	
On boiler	10
Play in bushings	3
Gear works hard	1
Key in rod loose	3
Lever not holding	3
Lever bracket loose	3
Reverse rod broken	1
Total	142

Hand reverse, defects classified

Gear works hard	3
Lost motion	1
Total	4

1879

Exhibit 57

Exhibit no. 57 is a statement showing cost of applying power reverse gears to steam locomotives on the Union Pacific System not so equipped as of September 1, 1931:

Weight on drivers (pounds)	Passenger		Freight		Switch		Total	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost
(5) Under 100M	7	3,314					7	3,314
(6) Including 100M to 150M	91	43,079	40	18,936	57	26,984	188	88,999
(7) Including 150M to 200M	21	9,941	336	159,062	120	56,806	477	225,811
(8) Including 200M to 250M					1	473	1	473
(9) Including 250M to 300M								
(10) Including 300M to 350M								
(11) Including 350M to 400M								
(12) Including 400M & Over								
Total	199	56,334	376	177,998	178	84,265	673	318,597

Remarks: Cost is based upon manufacturer's price, labor assembling and applying and store and shop expense for handling and supervision.

Exhibit 58

Exhibit no. 58 consists of a series of replies from a number of railroads in answer to a query sent out by the Mechanical Division of the American Railway Association. It covers all locomotives owned by the railroads replying to this questionnaire. The following table however covers only those locomotives included in exhibit 58 which are within the scope of the Commission's order and are shown by classes and by roads as to power and hand reverse gears:

1880 *Exhibit No. 58*

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
A., C. & Y.	7	Road	193,000	Hand	
Do	4	do	218,000	Power	2 Alco; 2 Barco.
Do	3	Switch	213,000	Power	2 Alco; 1 Franklin.
Do	2	do	219,000	Power	2 Alco.
Ann Arbor	2	Road	192,000	Hand	
Do	7	do	192,000	Power	Alco G.
Do	1	do	192,120	Power	Ragonnet.
Do	1	do	197,120	Hand	
Do	2	do	197,120	Power	Alco G.
Do	3	do	208,000	Hand	
Do	3	do	228,100	Power	Ragonnet.
Do	5	do	228,500	Power	Alco E.
Do	4	do	276,000	Power	Ragonnet.
Do	2	do	200,000	Power	Lewis.
A., T. & S. F.	43	Switch	215,200	Power	Ragonnet B.
Do	7	do	175,500	Power	Ragonnet B.
Do	2	do	143,700	Hand	
Do	40	do	144,500	Hand	
Do	11	do	210,800	Power	Ragonnet A.
Do	2	do	210,800	Power	Ragonnet B.
Do	4	Road	163,150	Hand	
Do	17	Switch	163,150	Hand	
Do	3	Road	154,880	Hand	
Do	7	Switch	154,880	Hand	
Do	8	Road	161,650	Hand	
Do	9	Switch	161,650	Hand	
Do	3	Road	179,965	Power	Ragonnet B.
Do	31	Switch	179,965	Power	Ragonnet B.
Do	1	do	179,965	Hand	
Do	1	do	191,400	Power	Ragonnet B.
Do	10	do	186,727	Power	Ragonnet B.
Do	30	do	222,800	Power	Ragonnet B.
Do	5	Road	163,150	Hand	
Do	2	do	213,000	Hand	
Do	3	do	213,000	Power	Alco.
Do	4	do	213,000	Power	Ragonnet A.
Do	6	Switch	213,000	Power	Ragonnet B.
Do	78	Road	272,700	Power	Ragonnet A
Do	70	do	272,700	Power	Ragonnet B.
Do	20	Switch	272,700	Power	Ragonnet A.
Do	30	do	272,700	Power	Ragonnet B.
Do	1	Road	234,580	Power	Ragonnet B.
Do	1	Switch	237,000	Power	Ragonnet B.
Do	2	do	238,400	Power	Ragonnet B.
Do	4	Road	172,900	Hand	
Do	6	Switch	172,900	Hand	
Do	56	Road	167,800	Power	Alco.
Do	20	do	167,800	Power	Barco.
Do	20	do	167,500	Power	Ragonnet B.
Do	46	do	167,500	Hand	
Do	18	do	804,300	Power	Ragonnet A.
Do	3	do	168,100	Hand	
Do	7	do	168,100	Power	Alco.
Do	13	do	168,100	Power	Ragonnet B.
Do	3	do	180,300	Power	Alco.
Do	13	do	151,900	Hand	
1881 Do	28	do	162,700	Power	Ragonnet B.
Do	1	do	167,500	Hand	
Do	26	do	167,500	Power	5 Alco and 21 Ragonnet.
Do	4	do	150,500	Hand	
Do	2	do	150,500	Power	Ragonnet B.
Do	6	do	150,500	Power	1 Alco and 5 Ragonnet B.
Do	117	do	167,100	Power	26 Ragonnet A and 91 Ragonnet B.
Do	88	do	194,100	Power	1 Alco and 87 Ragonnet B.
Do	19	do	216,600	Hand	
Do	35	do	216,600	Power	21 Alco and 14 Ragonnet A & B.
Do	8	Switch	216,600	Power	6 Alco; 2 Ragonnet B.
Do	119	do	155,872	Hand	
Do	3	do	135,200	Hand	
Do	4	do	154,350	Hand	
Do	3	do	131,200	Hand	
Do	3	do	135,100	Hand	
Do	1	do	138,500	Hand	
Do	3	do	138,500	Power	Alco.
Do	2	do	194,000	Power	Ragonnet A.
Do	1	do	196,300	Power	Ragonnet A

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
A., T. & S. F.—Continued	19	Road	215,500	Power	Alco.
Do	6	do	197,000	Power	Alco.
Do	8	Switch	197,000	Power	7 Alco and 1 Ragonnet B.
Do	2	do	184,000	Power	Alco.
Do	2	do	196,000	Power	Alco.
Do	2	Road	178,300	Power	Alco.
Do	5	do	161,500	Power	Alco.
Do	5	do	227,060	Power	Ragonnet A.
Do	29	do	220,200	Power	Ragonnet A.
Do	30	do	226,300	Power	Ragonnet A.
Do	229	do	260,000	Power	Ragonnet 2A and 227B.
Do	2	Switch	258,800	Power	Ragonnet B.
Do	50	Road	191,500	Power	Ragonnet B.
Do	10	do	198,300	Power	Ragonnet B.
Do	1	do	172,550	Power	Ragonnet A.
Do	51	do	246,300	Power	Ragonnet B.
Do	14	do	272,880	Power	4 Alco; 10 Ragonnet B.
Do	141	do	320,000	Power	Ragonnet B.
Do	15	do	268,200	Power	Ragonnet B.
Do	1	do	348,200	Power	Alco.

Totals for A. T. & S. F. 464 hand reverse and 1,485 power reverse as of July 13, 1931.

A., B. & C	3	Switch	133,500	Power	Ragonnet.
Do	7	do	150,226	Power	Ragonnet.
Do	3	Road	187,000	Power	Alco.
Do	12	do	187,000	Power	Alco.
Do	2	do	200,000	Power	Alco.
Do	3	do	250,000	Power	Alco.
1882 A. C. L	8	Switch	161,750	Hand	
Do	10	do	161,750	Power	5 Lewis; 5 Mellin.
Do	5	do	161,750	Power	5 Ragonnet B.
Do	20	do	213,710	Power	20 Ragonnet B.
Do	15	do	213,710	Power	15 Ragonnet E.
Do	35	Road	168,000	Power	Ragonnet B.
Do	35	do	168,000	Power	Lewis.
Do	75	do	177,100	Power	Alco E.
Do	90	do	177,100	Power	Ragonnet B.
Do	12	do	180,300	Hand	
Do	6	do	180,300	Power	4 Brown; 2 Ragonnet B.
Do	17	do	223,200	Power	Ragonnet.
Do	10	do	176,500	Power	3 Brown; 1 Ragonnet A; 6 Ragonnet B.
Do	20	do	303,060	Power	Alco.
B. & O. Chicago Terminal	10	Switch	164,250	Power	Ragonnet A.
Do	2	do	210,000	Power	Alco B.
Do	4	do	169,140	Power	Ragonnet A.
B. & O	75	Switch	138,500	Hand	
Do	8	do	138,500	Power	Alco.
Do	40	do	138,500	Power	Ragonnet A.
Do	290	Road	181,200	Hand	
Do	22	do	181,200	Power	Ragonnet A & B.
Do	10	Switch	163,700	Power	Ragonnet A.
Do	195	do	216,200	Power	Ragonnet A & B.
Do	18	Road	160,200	Hand	
Do	33	do	160,200	Power	Ragonnet A & B.
Do	63	do	160,200	Screw	
Do	11	do	189,400	Screw	
Do	36	do	189,400	Hand	
Do	44	do	189,400	Power	Alco; Barco; and Ragonnet.
Do	80	do	222,000	Screw	
Do	322	do	222,000	Hand	
Do	39	do	222,000	Power	Ragonnet.
Do	120	do	247,000	Screw	
Do	16	do	247,000	Power	Ragonnet B.
Do	125	do	344,400	Screw	
Do	29	do	344,400	Power	Ragonnet A.
Do	4	do	267,500	Power	Alco; Barco; and Precision.
Do	2	Switch	349,500	Power	Ragonnet B.
Do	1	Road	334,550	Power	Mellin.
Do	68	do		Power	Ragonnet A & B.
Do	42	do	462,500	Power	Alco; Barco; and standard.
Do	2	do	372,500	Power	Barco.
Do	21	do	464,800	Power	Ragonnet B; Mellin.

418 screw reverse, 640 power reverse, and 1,296 hand reverse as of July 18, 1931.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
1883 Bangor & A	7	Road	204,000	Power	Alco.
Do	3	do	179,500	Power	1 Alco; 2 Raggonet.
Do	11	do	182,000	Power	Alco.
Do	4	do	190,000	Power	Alco
Do	1	do	192,100	Power	Alco.
Do	1	Switch	131,000	Hand	
Do	1	do	217,000	Power	Alco.
B. & L. E	1	Road	384,300	Power	Precision.
Do	9	do	362,050	Power	Precision.
Do	19	do	334,250	Power	Precision.
Do	1	do	337,430	Power	Precision.
Do	55	do	294,425	Power	Precision.
Do	2	do	248,140	Power	Ragonnet B.
Do	2	do	236,500	Power	Ragonnet B.
Do	4	Switch	228,125	Power	Ragonnet A & B.
Do	2	do	231,375	Power	Ragonnet A & B.
Do	10	do	182,645	Hand	
Do	16	Road	188,000	Hand	
Do	4	do	188,000	Power	Ragonnet E.
Do	10	do	189,000	Power	2 Precision; 8 Ragonnet E.
Do	8	Switch	190,000	Power	1 Ragonnet A; 7 Ragonnet E.
Do	4	do	185,450	Power	Ragonnet A.
Do	4	do	159,900	Hand	
Do	1	do	165,300	Hand	
Do	3	do	147,700	Power	Ragonnet A.
Do	3	do	132,540	Hand	
Boston & A	5	Road	180,000	Power	Ragonnet E.
Do	10	do	188,000	Power	Precision F.
Do	10	do	185,750	Power	Precision D & F.
Do	15	do	177,800	Power	Precision D.
Do	44	do	152,200	Hand	
Do	6	do	152,200	Power	Precision D.
Do	55	do	250,100	Power	Precision F.
Do	9	do	155,700	Hand	
Do	9	do	161,000	Hand	
Do	9	do	210,700	Hand	
Do	21	do	212,400	Hand	
Do	4	do	214,000	Hand	
Do	7	do	216,200	Power	Precision B & D.
Do	17	do	216,400	Power	Precision B & D.
Do	4	do	302,500	Power	Alco E.
Do	4	do	303,900	Power	Alco E.
Do	5	do	303,900	Power	Ragonnet B.
Do	18	Switch	165,400	Power	Ragonnet A.
Do	11	do	165,400	Power	Alco E.
Do	4	do	172,600	Power	Ragonnet A.
Do	5	do	172,600	Power	Alco E.
Do	6	do	216,200	Power	Ragonnet A.
Do	12	do	216,200	Power	Alco E.
Do	6	do	219,000	Power	Ragonnet B.
Do	12	do	194,500	Power	Ragonnet A.
1884 Boston & M	17	Switch	140,000	Hand	
Do	13	do	140,000	Power	Alco.
Do	12	do	150,000	Hand	
Do	11	do	150,000	Power	Alco.
Do	2	do	229,000	Power	Alco.
Do	22	do	221,000	Power	Alco.
Do	15	do	246,300	Power	Ragonnet E.
Do	63	Road	156,600	Hand	
Do	39	do	187,000	Hand	
Do	1	do	187,000	Power	Ragonnet E.
Do	94	do	198,600	Hand	
Do	1	do	198,600	Power	Alco.
Do	10	do	172,300	Power	Alco.
Do	30	do	310,200	Power	Alco.
Do	50	do	152,200	Hand	
Do	20	do	152,200	Power	Alco.
Do	20	do	250,200	Power	Precision.
Do	5	do	255,800	Power	Precision.
Buffalo & S	43	Road	165,500	Hand	
Buffalo Creek	4	Switch	143,000	Hand	
Do	1	do	143,000	Power	Ragonnet.
Do	3	do	206,500	Power	Ragonnet.
Do	3	do	211,000	Power	Ragonnet.
Do	5	do	209,500	Power	Alco.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
B., R. & P.	5	Switch	144,100	Hand	
Do	9	do	231,000	Power	Mellin.
Do	9	do	233,000	Power	Alco.
Do	10	Road	355,500	Power	Ragonnet E.
Do	16	do	358,000	Power	8 Mellin; 8 Ragonnet E.
Do	15	do	362,000	Power	8 Mellin; 7 Ragonnet E.
Do	14	do	367,500	Power	Alco.
Do	4	do	155,000	Hand	
Do	10	do	156,700	Hand	
Do	3	do	163,500	Power	Ragonnet E.
Do	9	do	166,500	Power	Ragonnet E.
Do	5	do	169,000	Power	Ragonnet E.
Do	8	Switch	164,000	1 Power 1 Hand	Ragonnet E.
Do	1	Road	172,500	Hand	
Do	1	do	173,000	Hand	
Do	18	do	177,000	Hand	
Do	1	do	178,000	Hand	
Do	3	Switch	173,500	Hand	
Do	2	Road	170,000	Hand	
Do	8	do	175,500	Hand	
Do	12	do	174,000	Hand	
Do	1	do	174,000	Power	Ragonnet E.
Do	17	do	180,500	Hand	
Do	2	do	179,000	Hand	
Do	7	do	500,000	Power	3 Mellin; 4 Ragonnet E.
Do	2	do	502,500	Power	Alco.
Do	8	Switch	250,000	Power	1 Alco; 1 Brown; 6 Mellin.
Do	7	Road	217,000	Power	Ragonnet E.
Do	40	do	217,500	Power	Ragonnet E.
1885 Burl.-R.I.	16	Road	161,300	Hand	
B. A. & P.	3	Switch	167,000	Hand	
A. & St. L.	5	Road	156,700	Hand	
Do	5	do	184,000	Hand	
Do	15	do	220,000	Power	1 A.S.; 14 Ragonnet.
Do	4	Switch	148,100	Power	Casey-Cavin.
Do	4	do	163,500	Power	Alco.
C. & St. L.	1	Switch	163,500	Power	Alco.
D., W. & P.	1	Switch	137,600	Hand	
Do	2	do	172,360	Hand	
Do	2	do	172,360	Power	Ragonnet.
Do	10	Road	215,500	Hand	
Do	1	Switch	144,500	Hand	
G. T. W.	14	Road	156,700	Hand	
Do	6	do	156,700	Power	Casey-Cavin.
Do	15	do	184,800	Hand	
Do	8	do	213,500	Screw	
Do	2	do	213,500	Power	1 Alco; 1 Ragonnet.
Do	24	do	204,700	Screw	
Do	1	do	204,700	Power	Alco.
Do	10	do	215,300	Power	1 Alco; 3 Mellin; 6 Ragonnet.
Do	25	do	220,000	Power	21 Alco; 4 Ragonnet
Do	8	do	231,000	Power	Alco.
Do	10	do	230,500	Power	Precision.
Do	5	do	170,000	Power	Precision.
Do	3	do	184,540	Power	Precision.
Do	5	do	231,370	Power	Precision.
Do	12	do	234,500	Power	Precision.
Do	1	Switch	148,100	Hand	
Do	31	Road	148,100	Power	1 Lewis; 30 Casey-Cavin.
Do	3	Switch	153,400	Power	Casey-Cavin.
Do	25	do	174,000	Power	Ragonnet.
Do	3	do	180,000	Power	Ragonnet.
Do	5	do	165,000	Power	1 Mellin; 4 Casey-Cavin.
Do	5	do	249,000	Power	Ragonnet.
Do	5	do	208,000	Power	Ragonnet.
Do	15	do	211,000	Power	5 Alco; 10 Ragonnet.
Do	10	do	214,000	Power	5 Alco; 5 Ragonnet.
Do	10	do	211,200	Power	7 Alco; 3 Ragonnet.
Do	12	do	215,150	Power	Alco.
U.S. & Canada	1	Road	184,800	Hand	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Canadian Pac	2	Road	193,000	Screw	
Do	1	do	168,500	Hand	
Do	3	do	168,500	Power	Ragonnet.
Do	14	do	172,000	Hand	
Do	2	do	172,000	Power	Ragonnet.
Do	2	do	212,000	Screw	
1886 C. of G	2	Switch	144,200	Hand	
Do	3	do	144,200	Power	Dickert.
Do	3	do	148,800	Power	Dickert.
Do	4	do	148,800	Power	Ragonnet A.
Do	19	do	175,000	Power	Dickert.
Do	1	do	175,000	Power	Ragonnet A.
Do	2	do	180,000	Power	Dickert.
Do	32	do	141,330	Power	Dickert.
Do	1	do	141,330	Power	Ragonnet.
Do	5	do	144,530	Power	4 Dickert; 1 Ragonnet A.
Do	10	Road	218,200	Power	Dickert.
Do	22	do	218,200	Power	Alco E.
Do	1	do	184,400	Power	Ragonnet A.
Do	24	do	184,400	Power	Dickert.
Do	10	do	198,100	Power	2 Dickert; 8 Alco E.
Do	4	do	226,760	Power	Ragonnet A.
Do	33	do	226,760	Power	Dickert.
Do	30	do	226,760	Power	Alco E.
Do	10	do	309,220	Power	Alco E.
Do	7	do	286,000	Power	Dickert.
C. of N.J	4	Road	151,000	Hand	
Do	29	do	153,600	Hand	
Do	6	do	163,500	Power	Alco E.
Do	4	do	164,600	Hand	
Do	10	do	169,000	Hand	
Do	20	do	170,800	Hand	
Do	5	do	205,900	Power	Alco G.
Do	5	do	190,390	Power	Alco E.
Do	1	do	190,390	Power	Ragonnet B.
Do	5	do	197,660	Power	Alco G.
Do	5	do	196,000	Power	Alco E.
Do	7	do	167,000	Hand	
Do	44	do	172,000	Hand	
Do	1	do	187,000	Hand	
Do	9	do	194,500	Hand	
Do	4	do	200,000	Hand	
Do	2	do	201,300	Hand	
Do	10	do	205,000	Hand	
Do	6	do	164,600	Hand	
Do	10	do	239,000	Power	1 Alco G; 9 Lewis A.
Do	10	do	251,000	Power	Lewis A.
Do	1	do	253,600	Power	Lewis A.
Do	25	do	253,500	Power	Alco E.
Do	20	do	250,500	Power	Alco E.
Do	20	do	254,000	Power	Alco E.
Do	23	Switch	142,000	Hand	
Do	26	do	150,000	Hand	
Do	10	do	163,500	Power	Lewis A.
Do	5	do	197,000	Power	Alco E.
Do	6	do	159,600	Hand	
Do	25	do	234,000	Hand	
Do	10	do	238,500	Power	Alco G.
Do	10	do	255,100	Power	1 Lewis A; 9 Alco G.
Do	5	do	262,800	Power	Alco G.
Do	8	do	264,610	Power	Alco G.
1887 C. Vermont	3	Switch	151,900	Power	Ragonnet B.
Do	8	do	208,000	Power	Ragonnet B.
Do	4	Road	215,500	Power	Alco G.
Do	4	do	172,360	Power	Ragonnet A.
Do	1	do	172,360	Power	Precision F.
Do	1	do	198,100	Power	Alco E.
Do	5	do	189,430	Power	Alco E.
Do	16	do	203,000	Power	Precision D.
Do	10	do	285,000	Power	Precision F.
C. & O	10	Road	243,560	Power	Ragonnet A.
Do	1	Switch	146,300	Hand	
Do	4	do	131,750	Hand	
Do	5	do	142,300	Hand	
Do	3	do	142,300	Power	Lewis.
Do	1	do	171,175	Power	Lewis.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
C. & O—Continued	15	Switch	295, 000	Power	Lewis.
Do	20	do	221, 000	Power	10 Alco; E; 10 Ragonnet A.
Do	15	do	228, 340	Power	Alco G.
Do	65	do	240, 000	Power	Alco G.
Do	3	Road	157, 200	Hand	
Do	24	do	157, 200	Power	Alco E & G.
Do	8	do	190, 000	Power	Alco E.
Do	6	do	191, 455	Power	Lewis.
Do	11	do	200, 000	Power	Alco E.
Do	10	do	212, 000	Power	Ragonnet A.
Do	20	do	215, 000	Power	Ragonnet A & E.
Do	10	do	168, 500	Hand	
Do	33	do	168, 500	Power	Lewis
Do	58	do	163, 900	Hand	
Do	57	do	163, 900	Power	1 Brown; 2 Alco, 54 Lewis.
Do	2	do	173, 600	Hand	
Do	12	do	173, 600	Power	1 Alco; 31 Lewis.
Do	14	do	176, 150	Hand	
Do	25	do	176, 150	Power	2 Sheedy; 4 Alco; 19 Lewis.
Do	2	do	178, 600	Power	
Do	13	do	178, 400	Hand	
Do	36	do	178, 400	Power	5 Alco; 31 Lewis.
Do	2	do	161, 800	Power	Aco E.
Do	3	do	182, 800	Power	Lewis.
Do	1	do	181, 000	Power	Lewis.
Do	2	do	199, 000	Power	Lewis.
Do	19	do	337, 500	Power	Alco E.
Do	25	do	365, 500	Power	Lewis.
Do	146	do	364, 900	Power	99 Alco; 47 Ragonnet.
Do	20	do	358, 000	Power	Alco.
Do	45	do	368, 500	Power	Alco E & G.
Do	25	do	491, 000	Power	1 Sheedy; 25 Alco.
Do	20	do	491, 840	Power	Alco E.
Do	3	do	239, 000	Power	Alco G.
Do	7	do	243, 000	Power	Alco E & G.
Do	11	do	244, 500	Power	Ragonnet A.
Do	56	do	244, 500	Power	2 Lewis; 54 Alco.
1888 Do	50	do	268, 000	Power	Alco E.
Do	50	do	271, 500	Power	Alco E.
Do	50	do	273, 500	Power	Alco E.
Do	1	do	184, 500	Power	Ragonnet.
Do	1	do	185, 900	Power	Ragonnet.
Do	2	do	180, 970	Power	Ragonnet.
Do	40	do	373, 000	Power	Precision F.
C. & A	5	Road	224, 500	Power	Alco.
Do	10	do	220, 000	do	Ragonnet.
Do	5	do	227, 490	do	Ragonnet.
Do	20	do	217, 800	do	Ragonnet.
Do	20	do	214, 500	Hand	
Do	9	do	212, 300	do	
Do	1	Switch	212, 300	do	
Do	2	Road	318, 504	Power	Alco.
Do	1	do	172, 776	do	Ragonnet.
Do	9	do	172, 417	do	Ragonnet.
Do	8	do	154, 000	Hand	
Do	2	do	154, 000	Power	1 Barco; 1 Ragonnet.
Do	3	Switch	172, 000	Hand	
Do	10	Road	203, 500	do	
Do	13	do	184, 860	do	
Do	7	Switch	184, 860	do	
Do	10	Road	180, 500	do	
Do	4	do	174, 666	Power	3 Ragonnet; 1 Std.
Do	4	Switch	170, 000	Hand	
Do	10	do	142, 200	do	
Do	3	do	151, 155	do	
Do	31	Road	151, 155	do	
Do	15	Switch	167, 000	do	
Do	2	do	154, 900	do	
Do	5	do	144, 000	do	
Do	5	do	142, 490	do	
Do	23	do	144, 100	do	
C. & E. I	26	Road	160, 650	Hand	
Do	4	do	157, 000	do	
Do	2	Switch	157, 000	do	
Do	1	do	161, 625	do	
Do	9	Road	161, 625	do	
Do	9	do	155, 050	do	
	10	Switch	155, 050	do	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
C. & E. T.—Continued	7	Switch	155,050	Power	Ragonnet A.
Do	41	Road	152,750	Hand	
Do	17	Switch	152,750	do	
Do	8	Road	165,150	do	
Do	2	do	174,000	do	
Do	6	do	189,000	Power	Alco G.
Do	2	Switch	231,400	do	Alco B.
Do	1	do	231,400	Hand	
Do	21	Road	220,500	do	
Do	4	Switch	220,500	do	
Do	15	Road	220,000	Power	Ragonnet B.
Do	20	do	232,500	do	Alco E.
Do	7	do	290,800	do	Ragonnet E.
Do	9	Switch	142,500	Hand	
1889 Do	19	do	160,000	do	
Do	16	do	160,660	do	
Chi. & Ill. M	1	Road	170,520	Power	Alco G.
Do	2	do	175,440	do	Alco G.
Do	2	do	171,540	do	Alco G.
Do	2	do	177,060	do	Alco G.
Do	1	do	181,800	Hand	
Do	4	do	179,640	do	
Do	2	do	190,960	do	
Do	2	do	226,000	Power	Alco G.
Do	2	do	276,860	do	Alco G.
Do	2	do	281,100	do	Alco G.
C. & N. W	40	Road	154,000	Hand	
Do	40	do	154,500	do	
Do	1	do	163,000	Power	Alco.
Do	29	do	163,000	Hand	A.
Do	18	do	164,500	do	
Do	20	do	168,500	Power	Alco.
Do	20	do	174,000	do	Alco.
Do	12	do	175,500	do	Barco.
Do	35	do	288,000	do	Alco.
Do	34	do	229,500	do	Alco.
Do	156	do	229,500	do	2 Barco; 154 Ragonnet.
Do	103	do	233,000	do	40 Alco; 63 Barco.
Do	13	do	234,500	do	Barco.
Do	2	Switch	229,500	do	Ragonnet.
Do	2	do	233,000	do	Barco.
Do	12	Road	253,500	do	Barco.
Do	32	Switch	130,500	Hand	
Do	90	do	140,500	do	
Do	35	do	174,500	Power	Ragonnet.
Do	40	do	184,000	do	Alco.
Do	35	do	163,500	do	Alco.
Do	8	do	231,000	do	Alco.
Do	[illegible]	Road	[illegible]	do	Alco.
Do	3	do	209,500	do	Barco.
Do	34	Road	214,500	do	Barco.
Do	11	Switch	214,500	do	Barco.
C. & W. I	9	Switch	166,000	Hand	
Do	5	do	216,000	do	
Do	6	do	164,000	do	
C., B. & Q	15	Road	161,500	Hand	
Do	55	do	155,200	do	
Do	15	do	153,100	do	
Do	35	do	158,000	do	
Do	22	do	180,800	Power	Barco.
Do	12	do	207,730	do	Barco B–4.
1890 Do	8	do	235,500	do	Barco B–4.
Do	13	do	247,020	do	Barco B–3.
Do	5	do	301,800	do	Ragonnet.
Do	24	do	300,700	do	Ragonnet.
Do	47	do	307,600	do	Ragonnet.
Do	10	do	307,600	do	Mellin.
Do	18	do	353,820	do	Barco B–4.
Do	51	do	209,240	Hand	
Do	9	do	209,240	Power	1 T.D.; 2 Ragonnet. 6 Alco.
Do	148	do	214,550	do	8 Barco; 140 Ragonnet.
Do	45	do	227,000	do	Ragonnet.
Do	54	do	248,710	do	Ragonnet.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of powre reverse gear
C., B. & Q.—Continued	60	Road	239,900	Power	Ragonnet.
Do	15	do	239,000	do	Lewis.
Do	8	do	274,000	do	Barco B-4.
Do	85	do	151,000	Hand	
Do	120	do	152,000	do	
Do	7	do	314,850	Power	Ragonnet.
Do	1	do	399,900	do	Ragonnet.
Do	35	Switch	179,200	Hand	
Do	9	do	176,700	do	
Do	10	do	214,000	Power	Lewis.
Do	7	do	256,300	do	Ragonnet.
Do	10	do	165,000	do	Mellin.
C. G. W	30	Switch	141,000	Hand	
Do	5	do	165,000	Power	Alco G.
Do	3	do	160,000	Hand	
Do	7	Road	162,000	do	
Do	1	Switch	162,700	do	
Do	7	do	202,200	do	
Do	13	Road	202,200	do	
Do	10	do	218,300	do	
Do	2	Switch	218,300	do	
Do	6	do	191,000	do	
Do	8	Road	162,840	do	
Do	30	do	221,000	Power	Ragonnet A.
Do	10	do	220,000	do	Alco G.
Do	6	do	280,000	do	Ragonnet B.
Do	1	Switch	280,000	do	Ragonnet B.
Do	36	Road	299,800	do	Alco G.
1891 C., I. & L	7	Switch	142,000	Hand	
Do	3	do	191,000	Power	Alco.
Do	12	Road	156,000	Power	Standard and Ragonnet.
Do	10	Switch	148,000	Hand	
Do	3	do	132,000	Power	Alco.
Do	2	do	134,000	Hand	
Do	5	Road	184,500	Hand	
Do	6	do	173,000	do	
Do	3	do	179,000	do	
Do	7	do	191,000	do	
Do	1	do	218,000	Power	Alco.
Do	33	do	218,000	Hand	
Do	5	do	220,000	Power	Ragonnet.
Do	6	do	247,500	Power	Alco.
Do	9	do	252,500	do	Alco.
Do	1	do	258,500	do	Alco.
Do	3	do	179,000	do	Standard.
Do	5	do	278,500	do	Mellin.
Do	3	do	278,500	do	Standard.
C., K. & S	1	Switch	137,000	Hand	
Do	1	do	168,000	Power	Ragonnet A.
C., M., St. P. & P	16	Road	156,400	Hand	
Do	53	Switch	156,400	Hand	
Do	10	do	174,800	Power	Ragonnet.
Do	5	do	154,500	Hand	
Do	4	do	156,000	do	
Do	8	Road	189,200	do	
Do	67	Switch	189,200	do	
Do	3	do	189,200	Power	Alco.
Do	2	Road	176,450	Hand	
Do	4	do	177,900	do	
Do	5	Switch	186,500	do	
Do	5	do	192,000	do	
Do	22	Road	197,500	do	
Do	21	Switch	197,500	Hand	
Do	2	Road	197,500	Power	Ragonnet.
Do	17	Switch	213,000	do	Alco.
Do	1	do	180,000	Hand	
Do	2	do	171,550	do	
Do	66	Road	157,200	do	
Do	3	do	169,580	Screw	
Do	14	do	160,100	Hand	
Do	5	do	160,100	Power	Alco.
Do	65	do	160,000	Hand	
Do	6	do	160,400	do	
Do	14	do	189,720	Power	1 A.S.; 2 Barco; 11 Alco.
Do	10	do	153,500	Hand	
Do	10	Switch	143,100	do	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
C., M., St. P. & P.—Con	157	Road	152,000	Hand	
Do	35	Switch	152,000	do	
Do	1	Road	152,500	do	
Do	20	Switch	216,500	Power	Alco.
Do	36	Road	216,500	Hand	
Do	5	Switch	216,500	Hand	
Do	21	Road	216,500	do	
1892 Do	100	do	216,400	Power	Ragonnet.
Do	100	do	220,950	do	Do.
Do	50	do	216,500	Hand	
Do	19	do	216,500	Power	2 Lewis; 17 Alco.
Do	49	Switch	216,500	do	Alco.
Do	91	Road	239,000	do	Lewis.
Do	7	do	239,000	do	1 Barco; 6 Alco.
Do	2	do	239,000	do	Lewis.
Do	5	do	323,500	do	American.
Do	2	Switch	323,500	do	Do.
Do	16	do	327,500	do	1 Lewis; 15 American.
Do	15	Road	323,800	do	Alco.
Do	1	do	253,680	do	Alco.
C. R. I. & P	66	Switch	140,000	Hand	
Do	4	do	140,000	Power	Ragonnet A.
Do	26	do	160,000	Hand	
Do	2	do	160,000	Power	Alco E.
Do	2	do	161,000	Hand	
Do	10	do	165,000	Power	Mellin.
Do	10	do	226,000	do	Alco E.
Do	2	Road	142,200	Hand	
Do	30	do	132,200	do	
Do	31	do	146,500	do	
Do	30	do	147,750	do	
Do	3	do	154,750	Power	Alco G.
Do	44	do	157,500	Hand	
Do	6	do	164,500	Power	Alco G.
Do	1	do	174,500	Screw	
Do	29	do	174,500	Power	Alco E.
Do	1	do	187,000	Power	Alco E.
Do	2	do	188,500	Hand	
Do	83	do	177,300	do	
Do	1	do	217,800	do	
Do	10	do	182,900	do	
Do	20	do	180,500	do	
Do	134	do	196,400	do	
Do	9	do	183,000	do	
Do	32	do	187,000	do	
Do	4	do	187,000	Power	Alco G.
Do	11	Switch	182,300	Hand	
Do	80	do	182,300	Power	Alco E & G.
Do	1	do	187,300	do	Alco E.
Do	6	do	187,300	Hand	
Do	3	do	146,000	do	
Do	12	do	153,280	do	
Do	15	Road	308,500	Power	Alco E.
Do	10	do	317,500	do	Do.
Do	7	do	258,800	do	Do.
Do	4	do	240,050	Screw	
Do	3	do	253,000	Power	Alco E.
Do	6	do	255,400	do	Do.
Do	20	do	220,000	Power	Ragonnet A.
Do	6	do	243,000	do	Do.
Do	34	do	245,250	do	Do.
Do	5	do	240,050	do	Alco E.
Do	1	do	238,000	Power	Alco E.
1903 Do	19	do	240,250	do	Ragonnet A.
Do	6	do	238,200	do	Ragonnet A.
Do	20	do	245,555	do	1 Alco; 19 Mellin.
Do	10	do	249,053	do	Alco E.
Do	4	do	249,545	do	Do.
Do	10	do	246,500	do	Do.
Do	19	do	249,045	do	Do.
Do	5	do	246,000	do	Do.
Do	14	do	254,000	do	Do.
Do	21	do	256,937	do	Do.
Do	1	do	247,000	do	Do.
Do	7	do	246,000	do	Do.
Do	3	do	267,000	do	Do.
Do	13	do	264,000	do	Alco G.
Do	12	do	263,000	do	Do.
Do	10	do	302,000	do	Mellin.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
C., R. I. & P.—Continued	2	Road	224, 100	Power	Alco E.
Do	3	do	253, 000	do	Do.
Do	6	do	255, 400	do	Do.
Do	8	do	249, 500	do	Do.
Do	12	do	254, 000	do	Do.
Do	5	do	258, 100	do	Do.
Do	5	do	252, 500	do	Do.
Do	1	do	255, 600	do	Do.
Do	6	do	261, 100	do	Do.
Do	1	do	260, 250	do	Do. G.
Do	1	do	253, 000	do	Do. G.
Do	5	do	255, 500	do	Do. G.
Do	1	do	265, 500	do	Do. G.
Do	54	do	266, 500	do	Do. G.
Do	10	do	266, 000	do	Do. G.
Do	18	do	163, 000	Hand	Do. G.
Do	3	do	210, 000	Power	Alco G.
Do	16	do	227, 500	do	Ragonnet E.
Do	16	do	227, 500	do	Ragonnet E.
Do	2	do	255, 200	do	Ragonnet A.
Do	10	do	239, 000	do	Alco E.
Do	8	do	249, 000	do	Alco E.
Do	4	Switch	156, 275	Hand	
Do	2	do	153, 600	do	
Do	9	do	138, 000	do	
Do	15	do	131, 500	do	
Do	9	do	173, 000	Power	Ragonnet A.
Do	8	do	163, 500	do	Alco E.
Do	3	do	163, 500	do	Lewis.
Do	1	do	163, 500	do	Lewis.
Do	8	do	239, 000	do	Alco G.
Do	2	do	214, 500	do	Ragonnet E.
C., C., C., & St. L	4	Switch	157, 100	Hand	
Do	2	do	157, 100	Power	Ragonnet A.
Do	62	do	157, 100	do	Ragonnet B.
Do	1	do	170, 150	Hand	
Do	52	do	170, 150	Power	Ragonnet B.
Do	69	Road	209, 100	Hand	
Do	28	do	209, 100	Power	A. S.
Do	5	do	209, 100	do	Precision F.
1894 Do	1	do	209, 100	do	Ragonnet B.
Do	14	do	214, 500	do	A.S.
Do	28	do	217, 750	do	A.S.
Do	6	do	217, 500	do	Ragonnet B.
Do	11	do	217, 500	Hand	
Do	204	do	213, 200	do	
Do	19	do	213, 200	Power	A.S.
Do	1	do	213, 200	do	Ragonnet B.
Do	1	do	213, 200	do	Ragonnet E.
Do	11	do	210, 300	do	A.S.
Do	25	do	221, 500	do	17 A.S.; 8 Ragonnet D.
Do	26	do	246, 000	do	24 A.S.; 2 Ragonnet B.
Do	24	do	249, 250	do	A.S.
Do	1	do	248, 000	do	A.S.
Do	69	do	248, 000	do	Precision D.
Do	40	do	244, 600	do	Precision D.
Do	20	do	187, 500	do	Precision F-1.
Do	14	do	177, 300	do	2 A.S.; 12 Prevision F.
Do	4	do	193, 800	Hand	
Do	5	do	194, 500	do	
Do	10	do	194, 500	Power	2 A.S.; 8 Precision F.
Do	5	do	167, 000	do	Precision D.
Do	1	do	186, 000	do	Alco E.
Do	10	do	184, 500	do	Precision F.
Do	10	do	184, 800	do	Precision F.
Do	5	do	184, 800	do	Precision D.
Do	3	do	172, 000	Hand	
Do	50	do	245, 500	Power	Precision F.
Do	2	Switch	270, 000	do	Ragonnet B.
Do	9	do	216, 300	do	Lewis.
Do	24	do	216, 300	do	Ragonnet B.
Do	20	do	216, 500	do	Ragonnet B.
Do	2	do	222, 500	do	Ragonnet B.
Do	20	do	208, 900	do	Ragonnet A.
Do	15	do	220, 000	do	Ragonnet B.
Clinchfield	2	Switch	175, 000	Power	Ragonnet A.
Do	8	do	178, 650	do	Ragonnet A.
Do	1	do	175, 000	do	Alco E.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Clinchfield—Continued	1	Switch	197, 900	Power	Lewis.
Do	6	Road	178, 650	Hand	
Do	1	do	178, 650	Power	Lewis.
Do	9	do	230, 000	do	Lewis.
Do	10	do	235, 000	do	Alco E.
Do	7	do	467, 000	do	Ragonnet B.
Do	10	do	478, 000	do	Ragonnet B.
Do	10	do	486, 000	do	Alco E.
Do	1	do	299, 250	do	Lewis.
Do	10	do	323, 800	do	Ragonnet A.
Do	3	do	153, 900	do	Lewis.
Do	2	do	176, 900	do	Lewis.
C. & S	17	Switch	143, 200	Hand	
Do	5	Road	160, 300	Hand	
Do	6	do	185, 630	Power	Ragonnet.
Do	12	do	181, 700	Hand	
Do	4	do	175, 200	Power	Franklin.
Do	30	do	175, 250	Hand	
Do	2	Switch	162, 200	Hand	
1895 Do	5	Road	224, 470	Hand	
Do	5	do	313, 200	Power	Barco.
Do	10	do	313, 200	do	Ragonnet.
Do	1	Switch	131, 200	do	Alco G.
D. & H	6	Switch	137, 850	Hand	
Do	26	do	139, 850	do	
Do	7	do	196, 750	Power	2 Ragonnet; 5 Alco.
Do	10	do	208, 000	do	2 Ragonnet; 5 Alco.
Do	14	do	265, 000	do	14 Alco.
Do	4	Road	160, 000	Hand	
Do	14	do	160, 000	Power	Alco.
Do	53	do	209, 600	Hand	
Do	53	do	209, 600	Power	Alco.
Do	43	do	236, 400	Hand	
Do	32	do	236, 400	Power	1 Ragonnet; 31 Alco.
Do	12	do	270, 000	do	12 Alco.
Do	1	do	267, 800	do	Alco.
Do	20	do	265, 500	do	2 Barco; 5 Alco; 13 Ragonnet.
Do	3	do	297, 500	do	3 Alco.
Do	13	do	465, 300	do	2 Ragonnet; 11 Alco.
Do	2	do	330, 300	do	Mellin.
Do	4	do	192, 500	Screw	Franklin.
Do	6	do	192, 500	Power	Alco.
Do	2	do	188, 150	do	Alco.
D., L. & W	34	Switch	131, 700	Hand	
Do	1	do	155, 675	do	
Do	50	do	132, 500	do	
Do	5	do	201, 000	do	
Do	2	do	199, 000	Power	Ragonnet.
Do	12	do	208, 000	do	Ragonnet.
Do	6	do	208, 000	do	Ragonnet.
Do	10	do	208, 000	do	Ragonnet.
Do	2	do	259, 000	do	Ragonnet.
Do	19	do	258, 000	do	Alco.
Do	11	Road	166, 000	Hand	
Do	15	Switch	166, 000	do	
Do	23	Road	169, 500	do	
Do	4	do	213, 000	Power	Ragonnet.
Do	1	Switch	213, 000	Hand	
Do	10	do	213, 000	Power	Ragonnet.
Do	31	Road	169, 500	Hand	
Do	23	Switch	169, 500	do	
Do	14	Road	166, 000	do	
Do	7	Switch	166, 000	do	
Do	7	do	156, 500	do	
Do	1	Road	152, 500	Power	Ragonnet.
Do	24	do	152, 500	Hand	
Do	2	Switch	152, 500	Hand	
Do	3	Road	144, 000	do	
Do	9	do	167, 500	do	
Do	15	do	168, 000	do	
Do	5	do	175, 800	do	
Do	3	do	169, 500	do	
Do	7	do	179, 500	Power	Alco.
Do	1	do	185, 500	do	Alco.
Do	6	do	186, 500	do	Alco.
Do	21	do	192, 500	do	17 Alco; 4 Ragonnet.

Exhibit No. 58—Continued

R.R. initials		No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
1896	D., L. & W—Con.	5	Road	197,300	Power	1 Ragonnet; 4 Alco.
	Do	1	do	189,600	do	Alco.
	Do	6	do	190,500	do	Ragonnet.
	Do	16	do	190,500	do	Alco.
	Do	27	do	246,500	do	Alco.
	Do	22	do	254,500	do	Ragonnet.
	Do	3	Switch	254,500	do	Ragonnet.
	Do	10	Road	253,500	do	Alco.
	Do	40	do	271,500	do	Alco.
	Do	10	do	276,500	do	Alco.
	Do	10	do	257,500	do	Alco.
	Do	5	do	289,000	do	Alco.
	Do	20	do	262,000	do	Alco.
	Do	11	do	274,000	do	Alco.
	Do	24	do	276,500	do	Alco.
	D. & R. G. W	13	Switch	150,000	Hand	
	Do	1	Road	155,950	do	
	Do	20	do	163,000	do	
	Do	23	do	164,690	do	
	Do	14	do	165,100	do	
	Do	5	do	177,000	do	
	Do	17	do	194,100	do	
	Do	51	do	194,100	do	
	Do	14	do	212,000	do	
	Do	10	do	345,300	Power	Alco D.
	Do	8	do	295,500	do	Mellin.
	Do	16	do	394,000	do	Do.
	Do	10	do	481,000	do	Alco E.
	Do	10	do	559,500	do	Alco G.
	Do	10	do	572,000	do	Do.
	Do	30	do	266,700	do	Alco E.
	Do	10	do	290,530	do	Precision.
	Do	14	do	264,900	do	Alco G.
	Do	6	do	160,640	Hand	
	D. & M	3	Road	155,000	Power	Precision.
	Do	3	do	165,000	do	1 Alco; 1 Barco; 1 Ragonnet.
	Do	2	do	170,000	do	1 Ragonnet; 1 Precision.
	Do	1	Switch	150,000	Hand	
	Do	3	do	150,800	Power	Alco.
	D., T. & I	1	Switch	146,000	Hand	
	Do	3	do	152,000	do	
	Do	1	do	185,000	do	
	Do	6	do	131,000	do	
	Do	6	do	217,000	do	
	Do	6	Road	170,000	do	
	Do	10	do	194,000	Screw	
	Do	5	do	194,000	Power	Lewis.
	Do	20	do	204,000	Hand	
	Do	2	do	226,000	Power	Lewis.
	Do	12	do	223,000	Hand	
	D., M. & N	11	Switch	164,000	Hand	
	Do	5	do	170,500	do	
	Do	16	do	170,500	Power	Ragonnet.
1897	Do	1	do	170,500	do	Alco G.
	Do	6	Road	276,600	do	A.S.
	Do	10	do	274,000	do	A.S.
	Do	8	do	392,000	do	1 A.S.; 7 Baldwin.
	Do	4	do	415,200	do	1 Ragonnet; 3 A.S.
	Do	3	do	173,360	do	Ragonnet.
	Do	6	Switch	195,300	do	Ragonnet B.
	Do	4	do	220,000	do	Ragonnet A.
	Do	4	do	332,500	do	Ragonnet E.
	Do	10	do	149,900	Hand	
	Do	5	Road	190,200	Power	Ragonnet.
	Do	9	Switch	190,200	do	Ragonnet A.
	Do	2	do	190,200	do	Alco G.
	Do	1	do	190,200	do	Ragonnet E.
	Do	17	do	190,200	Hand	
	Do	5	Road	294,400	Power	2 Ragonnet; 3 A.S.
	Do	4	do	294,400	do	1 Ragonnet; 3 A.S.
	Do	3	do	299,000	do	A.S.
	D.S.H. & A	2	Switch	130,000	Hand	
	Do	1	do	154,900	do	
	Do	6	Road	152,000	do	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
D. S. H. & A—Continued	2	Road	153,000	Power	Alco E.
Do	12	do	164,350	Hand	
Do	2	do	166,000	Power	Alco E.
Do	4	do	186,000	do	Alco G.
Do	2	do	201,500	do	Do.
C. J. & E	46	Road	239,940	Power	Alco & Ragonnet.
Do	29	do	244,500	do	Alco.
Do	12	Switch	194,000	do	Ragonnet.
Do	17	do	219,200	do	Ragonnet.
Do	8	do	214,120	do	Ragonnet.
Do	43	do	173,200	do	Ragonnet.
Do	32	Road	170,440	do	Ragonnet.
Erie	2	Switch	162,000	Hand	
Do	59	do	154,150	do	
Do	10	do	148,100	do	
Do	1	do	133,000	do	
Do	16	do	214,000	Power	Ragonnet.
Do	1	do	201,000	do	Ragonnet.
Do	21	do	201,000	Hand	
Do	30	do	230,210	Power	Ragonnet A.
Do	15	do	236,280	do	Franklin.
Do	10	do	237,300	do	Alco G.
Do	33	Road	182,900	Hand	
Do	3	do	194,340	do	
Do	70	Switch	176,400	do	
Do	16	Road	176,400	do	
Do	27	Switch	187,675	do	
Do	62	Road	187,675	do	
Do	25	Switch	184,000	do	
Do	1	do	232,700	Power	Ragonnet A.
Do	1	do	243,900	Screw	Alco.
Do	1	do	238,000	do	Alco.
Do	26	Road	243,900	do	Alco.
1898 Do	9	Switch	243,900	Power	Ragonnet A.
Do	39	do	238,000	do	Ragonnet A.
Do	3	do	238,000	do	Precision F.
Do	40	Road	243,900	do	Ragonnet A.
Do	5	do	243,900	do	Ragonnet B.
Do	1	do	238,000	do	Ragonnet B.
Do	18	do	238,000	do	Precision F.
Do	6	do	243,900	do	Precision F.
Do	15	do	239,000	do	Lewis.
Do	35	do	256,860	do	Precision F.
Do	5	do	256,860	do	Ragonnet B.
Do	1	do	256,090	do	Ragonnet B.
Do	25	do	276,000	do	Precision F.
Do	24	do	281,000	do	Precision F.
Do	1	do	281,000	do	Alco G.
Do	35	do	284,820	do	Precision F.
Do	20	do	286,500	do	Precision F.
Do	9	Switch	175,000	Screw	European.
Do	5	do	175,000	Power	Ragonnet A.
Do	2	do	175,000	do	Ragonnet B.
Do	38	Road	175,000	Screw	European.
Do	12	do	175,000	Power	Ragonnet B.
Do	10	do	342,900	do	Ragonnet A.
Do	30	do	337,400	do	Ragonnet A.
Do	1	Switch	327,250	do	Ragonnet A.
Do	1	do	337,400	do	Ragonnet A.
Do	1	do	345,500	do	Ragonnet A.
Do	5	do	338,000	do	Ragonnet A.
Do	10	Road	338,000	do	Ragonnet A.
Do	14	do	345,500	do	Ragonnet A.
Do	25	do	293,000	do	Lewis.
Do	59	do	154,700	Hand	
Do	5	do	184,270	Power	Precision F.
Do	10	do	183,800	do	Precision F.
Do	1	do	172,500	do	Precision F.
Do	18	do	186,500	do	Precision F.
Do	2	do	186,500	do	Ragonnet A.
Do	13	do	184,300	do	Precision E.
Do	11	do	184,300	do	Ragonnet A.
Do	10	do	190,500	do	Precision D.
Do	11	do	205,650	do	Precision F.
Do	9	do	197,000	do	Precision F.
Do	7	do	206,960	do	Precision D.
Do	3	do	198,960	do	Precision.
Do	1	do	203,480	do	Precision G.

Exhibit No. 58—Continued

	R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
	F. E. C.	2	Switch	146,000	Power	Home-made.
	Do.	2	do	154,000	do	Ragonnet.
	Do.	3	do	156,000	do	Alco.
	Do.	2	do	157,000	do	Alco.
	Do.	5	do	158,000	do	Do.
	Do.	5	do	215,000	do	Do.
	Do.	9	do	216,000	do	Do.
	Do.	12	do	218,000	do	Do.
	Do.	15	Road	191,500	do	Do.
	Do.	18	do	210,500	do	Do.
	Do.	1	do	212,000	do	Do.
	Do.	12	do	214,000	do	Do.
1899	Do.	15	do	191,500	do	Do.
	Do.	18	do	210,500	do	Do.
	Do.	1	do	212,000	do	Do.
	Do.	12	do	214,000	do	Do.
	Do.	1	do	214,500	do	Do.
	Do.	20	do	217,000	do	Do.
	Do.	15	do	221,500	do	Do.
	Do.	23	do	244,500	do	Do.
	F. S. & W.	6	Road	154,400	Power	Barco.
	F. W. & D. C.	7	Road	142,000	Hand	
	Do.	2	Switch	142,000	do	
	Do.	2	do	157,000	do	
	Do.	1	Road	157,000	do	
	Do.	6	do	165,000	do	
	Do.	6	Switch	165,000	do	
	Do.	9	Road	179,000	do	
	Do.	5	do	179,500	do	
	Do.	2	Switch	145,000	do	
	Do.	8	do	135,000	do	
	Do.	2	do	138,900	do	
	Do.	10	Road	212,500	do	
	Do.	5	do	239,000	Power	Lewis.
	Do.	5	do	240,000	do	Barco & Ragonnet.
	Do.	5	do	243,410	do	Ragonnet.
	Do.	4	do	153,000	Hand	
	Do.	5	do	173,500	Power	Ragonnet & Barco.
	Do.	2	do	179,600	do	Ragonnet.
	Georgia	1	Road	214,000	Power	Ragonnet A.
	Do.	2	do	214,000	do	Alco E.
	Do.	1	do	214,000	do	Ragonnet B.
	Do.	7	do	225,600	do	Alco E.
	Do.	2	Switch	214,000	do	Ragonnet B.
	G. & F.	9	Road	164,000	Hand	
	G. N.	125	Road	169,696	Hand	
	Do.	47	do	151,000	do	
	Do.	80	do	232,276	do	
	Do.	191	do	232,276	Power	
	Do.	45	do	324,000	Power	Ragonnet.
	Do.	19	do	384,000	do	Do.
	Do.	25	do	420,000	do	Do.
	Do.	30	Road	538,773	do	Do.
	Do.	136	do	155,413	Hand	
	Do.	28	do	242,000	Power	Ragonnet.
	Do.	20	do	254,290	do	6 Ragonnet; 14 Barco.
	Do.	91	Switch	141,508	Hand	Ragonnet.
	Do.	41	do	217,422	Power	Ragonnet.
	Do.	2	do	217,422	Hand	
	Do.	52	do	217,422	Power	
	Do.	28	do	175,396	Hand	6 Lewis; 46 Ragonnet.
	Do.	14	do	154,000	do	
1900	G. M. & N.	8	Road	153,200	Hand	
	Do.	4	do	160,800	do	
	Do.	3	do	176,300	Screw	
	Do.	7	do	176,300	Power	Ragonnet E.
	Do.	16	do	227,000	do	Do.
	Do.	8	Switch	158,000	Hand	
	H. & B. T. M.	4	Road	161,820	Hand	
	Do.	2	do	173,500	do	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
I. C	57	Road	155, 450	Power	Ragonnet A.
Do	1	do	155, 450	Hand	
Do	53	do	173, 700	Power	Ragonnet A.
Do	75	do	178, 650	do	Do.
Do	3	do	178, 650	Hand	
Do	43	do	181, 000	Power	Ragonnet A.
Do	7	do	181, 000	Hand	
Do	32	do	214, 050	Power	Ragonnet A.
Do	15	do	214, 050	do	Do.
Do	6	do	214, 050	Hand	Do.
Do	4	Switch	161, 000	Power	Ragonnet A.
Do	27	do	142, 000	do	Do.
Do	2	do	142, 000	Hand	
Do	40	do	166, 000	Power	Ragonnet A.
Do	92	do	169, 000	do	Do.
Do	7	do	134, 070	do	Do.
Do	70	do	221, 700	do	Do.
Do	2	do	308, 300	do	Do. B.
Do	38	Road	152, 700	do	Do. A.
Do	70	do	154, 700	do	Do.
Do	3	do	163, 480	do	Do. B.
Do	65	do	169, 500	do	Do. A.
Do	15	do	243, 500	do	Do. A.
Do	45	do	247, 000	do	Precision D.
Do	13	do	168, 400	do	Ragonnet B.
Do	32	do	220, 450	do	Ragonnet A.
Do	370	do	218, 300	do	Do.
Do	136	do	230, 000	do	Do.
Do	1	do	233, 150	do	Do.
Do	51	do	248, 000	do	Precision F.
Do	5	do	220, 240	do	Ragonnet B.
Do	125	do	296, 500	do	Do. A.
Do	10	Switch	370, 000	do	Do. B.
Indiana H. B	15	Switch	160, 000	Hand	
Do	8	do	170, 500	Power	Mellin.
Do	1	do	144, 500	do	Alco.
Do	15	do	144, 500	do	Ragonnet B.
Do	20	do	148, 700	do	Ragonnet A.
Do	5	do	148, 700	do	Ragonnet B.
Do	14	do	163, 500	do	Lewis.
Do	5	Road	220, 700	do	Ragonnet B.
Do	10	do	215, 500	do	Do.
Do	5	do	283, 100	do	Do.
Do	15	do	231, 500	do	Do.
Do	5	do	231, 000	do	Do.
Do	7	Switch	239, 800	do	Mellin.
Do	10	do	239, 800	do	Ragonnet A.
Do	5	do	217, 000	do	Do.
Do	51	do	219, 200	do	Do. B.
Do	3	do	294, 000	do	Do.
1901 L. V	23	Road	154, 000	Hand	
Do	23	do	154, 000	do	
Do	17	do	150, 700	do	
Do	11	do	161, 940	Power	4 Ragonnet; 7 Precision.
Do	14	do	166, 280	do	10 Ragonnet; 4 Precision.
Do	15	do	162, 080	do	4 Ragonnet; 11 Precision.
Do	30	do	207, 660	do	1 Standard; 29 Ragonnet.
Do	20	do	204, 560	do	Ragonnet.
Do	12	do	181, 000	do	10 Alco; 2 Precision.
Do	13	Switch	164, 000	Hand	
Do	20	do	174, 850	do	
Do	3	do	158, 775	do	
Do	49	do	173, 500	do	
Do	35	do	208, 935	Power	Ragonnet B.
Do	1	do	224, 370	do	Ragonnet A.
Do	69	Road	183, 810	Hand	
Do	12	do	187, 900	do	
Do	8	do	205, 175	do	
Do	8	do	177, 610	do	
Do	14	do	235, 000	Power	Ragonnet A.
Do	28	Switch	235, 000	do	Do.
Do	45	Road	228, 200	do	Do.
Do	30	do	228, 200	do	Do.
Do	15	do	238, 200	do	Do.
Do	55	do	239, 000	do	Alco.
Do	20	do	241, 900	do	1 Pilloid; 19 Ragonnet.
Do	40	do	293, 560	do	Ragonnet A.
Do	6	do	246, 500	do	Alco.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
L. & A	2	Switch	144,000	Hand	
Do	6	Road	184,000	Power	Ragonnet B.
Do	5	do	176,200	do	1 Ragonnet; 4 Alco.
Do	2	do	176,200	Screw	
Do	12	do	153,000	Power	1 Alco; 11 Ragonnet.
Do	1	do	159,000	do	Alco.
Do	4	do	159,000	Hand	
Do	1	Switch	131,000	do	
L. & N. W	2	Road	188,300	Power	Standard.
L. A. & T	3	Road	172,500	Power	Alco G.
L. & N	8	Switch	132,000	Hand	
Do	6	do	137,400	do	
Do	10	do	143,000	do	
Do	25	do	144,200	do	
Do	2	do	173,600	Power	Ragonnet.
Do	26	do	214,000	do	6 Brown; 20 Alco.
Do	34	do	219,000	do	L. & N.
Do	2	Road	156,500	Hand	
Do	15	do	156,000	do	
Do	77	do	164,800	do	
Do	14	do	168,000	do	
Do	96	do	168,900	do	
Do	28	do	172,900	do	
Do	26	do	173,000	do	
Do	9	do	173,300	do	
1902 Do	17	do	175,900	do	
Do	9	do	177,000	do	
Do	42	do	197,000	do	
Do	9	do	197,000	Power	Alco.
Do	14	do	198,700	Hand	
Do	2	Switch	136,000	do	
Do	5	do	136,000	do	
Do	15	do	141,200	do	
Do	7	do	142,000	do	
Do	17	do	143,100	do	
Do	9	do	143,100	do	
Do	9	do	146,600	do	
Do	10	do	156,000	do	
Do	14	do	164,800	do	
Do	10	do	168,900	do	
Do	1	do	173,300	do	
Do	2	do	177,000	do	
Do	5	do	191,000	do	
Do	3	do	197,000	do	
Do	11	do	198,700	do	
Do	85	Road	220,000	Power	3 Lewis; 14 Ragonnet; 68 Alco.
Do	15	do	236,000	Hand	
Do	75	do	239,000	Power	20 Lewis; 55 Alco.
Do	4	do	241,700	Hand	
Do	35	do	241,700	Power	Alco E.
Do	1	do	245,500	do	Do.
Do	66	do	251,000	do	Do.
Do	34	do	255,000	do	Do.
Do	23	do	256,000	do	Do.
Do	1	do	260,000	do	Do.
Do	8	Switch	220,000	do	1 Ragonnet; 7 Alco.
Do	1	do	236,000	Hand	
Do	4	do	238,000	Power	Alco.
Do	1	do	241,700	do	Alco.
Do	2	do	241,700	Hand	
Do	14	Road	162,000	Power	6 Lewis; 8 Alco.
Do	13	do	177,000	do	Alco E.
Do	16	do	226,400	do	Do.
Do	6	do	226,910	do	Do.
Maine C	6	Switch	137,425	Hand	
Do	12	do	165,300	Power	Ragonnet.
Do	2	do	165,000	do	Do.
Do	1	do	132,000	Hand	
Do	12	Road	156,000	Power	Ragonnet & Alco.
Do	3	do	150,000	do	Alco.
Do	3	do	159,900	do	Do.
Do	2	do	171,500	do	Precision.
Do	8	do	167,000	Hand	
Do	15	do	172,500	do	
Do	4	do	218,500	Power	Alco E.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Maine C.—Continued	5	Road	213, 500	Power	Alco G.
Do	11	do	218, 500	do	Alco E.
Do	4	do	213, 500	do	Alco E.
Do	2	do	218, 500	do	Alco G.
Do	6	do	220, 000	do	Alco E.
1903 Do	2	do	171, 400	do	Alco E.
Do	1	do	262, 000	do	Do.
M. & P	8	Road	170, 300	Power	Alco.
Do	1	do	182, 180	do	Do.
Do	1	Switch	132, 000	do	Do.
Do	1	do	134, 000	Hand	
M. C	53	Switch	165, 000	Power	Ragonnet A.
Do	50	do	171, 000	do	Do.
Do	1	do	135, 900	Hand	
Do	15	do	136, 000	do	
Do	70	Road	215, 500	do	
Do	30	Switch	215, 500	Power	Ragonnet A.
Do	3	Road	168, 000	Hand	
Do	5	do	178, 000	do	
Do	1	do	174, 000	do	
Do	30	do	186, 500	Power	Precision.
Do	45	do	182, 500	do	Precision.
Do	58	do	154, 500	Hand	
Do	4	Switch	273, 250	Power	2 Ragonnet; 2 Casey; Cavin.
Do	2	do	466, 500	do	Ragonnet A.
Do	40	do	216, 250	do	Do.
Do	10	do	222, 500	do	Lewis.
Do	36	do	217, 360	do	Ragonnet B.
Do	1	Road	245, 000	do	Ragonnet A.
Do	11	do	245, 000	Hand	
Do	6	do	245, 000	Power	Precision D.
Do	52	do	246, 000	do	Precision D.
Do	66	do	246, 500	do	Precision D.
Midland V	2	Road	155, 500	Power	Barco.
Do	5	do	155, 500	do	Ragonnet.
Do	5	do	221, 000	do	Barco.
Do	1	do	190, 000	do	Do.
M. & St. L	10	Switch	172, 000	Power	Ragonnet.
Do	2	do	138, 900	Hand	
Do	2	do	142, 000	do	
Do	3	do	138, 000	do	
Do	6	do	146, 000	do	
Do	19	Road	150, 000	do	
Do	12	do	174, 000	do	
Do	20	do	171, 700	do	
Do	20	do	189, 500	Power	Ragonnet.
Do	15	do	186, 800	do	Alco E.
M. St. P. & St. Ste. M	4	Switch	131, 000	Hand	
Do	4	do	131, 000	Power	Alco.
Do	2	do	151, 000	Hand	
Do	13	do	151, 000	Power	6 Ragonnet; 7 Alco.
Do	1	do	190, 250	do	Alco.
Do	21	Road	231, 000	do	Alco G.
Do	35	do	223, 500	do	Do.
Do	39	do	197, 500	Hand	Do.
Do	7	do	197, 500	Power	Alco G.
Do	16	do	174, 800	do	Do.
1904 Do	18	do	174, 800	Hand	
Do	1	Switch	170, 100	do	
Do	16	do	170, 100	Power	Alco.
Do	3	Road	160, 000	do	Do.
Do	22	do	160, 000	Hand	
Do	6	do	170, 000	do	
Mississippi C	2	Switch	133, 500	Power	Alco.
Do	3	Road	186, 500	do	Do.
M. & N. A	5	Road	167, 300	Hand	
Do	1	do	164, 000	do	
Do	1	do	208, 000	Power	T. D. C.
Do	1	do	208, 000	Hand	
Do	2	do	214, 000	Power	
Do	6	do	214, 000	Hand	
Do	2	do	159, 100	do	
Do	2	do	163, 000	do	
Do	3	do	162, 000	do	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Mo.-Ill.	2	Road	168,000	Hand	
Do.	2	do	170,000	do	
Do.	2	do	168,000	do	
Do.	2	do	170,000	Power	Alco E.
Do.	4	do	192,000	do	Do.
Do.	1	do	152,800	Hand	
Do.	1	do	160,000	do	
Do.	1	do	160,000	Power	Alco E.
M. K. T.	7	Road	242,000	Hand	
Do.	33	do	242,000	Power	Alco G.
Do.	17	do	234,000	Hand	
Do.	28	do	234,000	Power	Alco G.
Do.	1	Switch	233,500	Hand	
Do.	34	Road	233,500	do	
Do.	14	Switch	214,500	do	
Do.	56	do	214,500	do	
Do.	9	do	199,000	do	
Do.	31	Road	199,000	do	
Do.	3	do	167,700	do	
Do.	1	do	167,000	do	
Do.	4	do	167,000	Power	Alco G.
Do.	5	do	165,000	Hand	
Do.	27	do	165,000	Power	Alco G.
Do.	10	do	155,000	Hand	
Do.	10	Switch	244,000	Power	Ragonnet B.
Do.	30	do	214,000	do	10 Alco; 20 Ragonnet.
Do.	25	do	159,200	Hand	
Do.	5	do	157,400	do	
Do.	12	do	153,200	do	
Do.	9	do	144,700	do	
905 M.P.	6	Road	183,550	Power	Ragonnet.
Do.	2	do	180,650	do	Alco E.
Do.	35	do	152,817	Hand	
Do.	1	do	196,000	do	
Do.	16	do	196,000	Power	Alco E.
Do.	6	do	196,000	do	Barco B.
Do.	10	do	208,390	do	Do.
Do.	10	do	248,500	do	Do.
Do.	5	do	267,500	do	Alco G.
Do.	5	do	190,500	do	Do.
Do.	6	do	192,500	do	Do.
Do.	4	Switch	130,000	Hand	
Do.	10	do	227,250	Power	Alco E.
K. C. S.	27	Road	195,660	Hand	
Do.	9	Switch	195,660	do	
Do.	15	Road	224,000	do	
Do.	4	Switch	157,500	Power	Mellin.
Do.	12	Road	352,000	do	Do.
Do.	7	do	466,000	do	Ragonnet A.
Do.	10	do	476,400	do	Alco E.
Do.	8	do	159,500	Hand	
Do.	3	do	166,500	Power	Ragonnet B.
Do.	11	Switch	189,850	do	Alco E.
Do.	12	do	239,380	do	Do.
Do.					
K. O. & G.	3	Switch	147,850	Power	Ragonnet.
Do.	4	Road	177,100	do	Do.
Do.	5	do	250,000	do	Barco.
L. S. & I.	1	Switch	152,000	Hand	
Do.	1	do	152,000	Power	Alco.
Do.	2	do	132,800	do	Alco G.
Do.	1	do	137,000	do	Do.
Do.	2	do	179,800	do	Ragonnet B.
Do.	1	do	152,000	do	Alco G.
Do.	6	Road	172,000	do	Do.
Do.	1	do	152,000	do	Do.
Do.	1	do	164,000	do	Do.
Do.	2	Switch	180,000	do	Do.
Do.	1	Road	182,000	do	Franklin E.
Do.	2	Switch	217,500	do	Alco G.
Do.	2	Road	240,000	do	Ragonnet B.
Do.	2	Switch	240,000	do	Do.
Do.	3	Road	293,560	do	Do.
L. & H. R.	13	Road	170,600	Hand	
Do.	6	do	283,800	Power	Ragonnet.
Do.	4	do	212,700	do	Do.
Do.	4	do	220,000	do	Do.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
L. & N. E.	1	Switch	140,000	Hand	
Do	1	do	174,300	do	
Do	9	do	207,800	do	
Do	3	do	205,760	do	
Do	3	do	269,800	Power	Alco G.
Do	6	Road	170,000	Hand	
Do	2	do	204,650	do	
Do	2	do	208,000	do	
Do	7	do	279,000	Power	Alco E.
Do	2	do	365,000	do	Alco G.
1906 Mo. Pac.	36	Road	192,800	Hand	
Do	11	do	192,800	Power	Alco E.
Do	101	do	192,800	do	Do.
Do	8	do	192,800	Hand	
Do	13	do	158,350	do	
Do	34	do	158,350	Power	Alco E.
Do	71	do	209,500	do	Do.
Do	9	do	209,500	Hand	
Do	25	do	220,000	Power	Alco E.
Do	79	do	237,500	do	Do.
Do	91	do	239,500	do	Do.
Do	1	do	246,000	do	Do.
Do	13	do	295,800	do	Do.
Do	9	do	329,500	do	Do.
Do	4	do	175,200	Hand	
Do	5	do	175,200	Power	Alco E.
Do	25	do	275,500	do	Alco G.
Do	7	do	208,000	do	Alco E.
Do	7	do	224,500	do	Do.
Do	9	do	226,000	do	Do.
Do	10	do	267,500	do	Alco G.
Do	1	do	191,000	do	Alco E.
Do	1	do	160,500	Hand	
Do	24	do	160,500	Power	Alco E.
Do	13	do	160,500	do	Do.
Do	1	do	160,500	Hand	
Do	5	do	166,500	Power	Alco E.
Do	10	do	183,200	do	Do.
Do	19	do	190,200	do	Do.
Do	1	Switch	295,800	do	Do.
Do	1	do	329,500	do	Do.
Do	1	do	414,800	do	B.L.W.
Do	20	do	163,100	do	Alco E.
Do	14	do	151,650	Hand	
Do	61	do	151,650	Power	17 Lewis; 44 Alco.
Do	36	do	133,700	do	1 Ragonnet; 15 Lewis; 20 Alco
Do	9	do	133,700	Hand	
Do	75	do	224,500	Power	Alco E
Do	4	do	192,800	do	Do.
Do	7	do	192,800	Hand	
Do	5	do	192,800	Power	Alco E.
Do	26	do	158,350	Hand	
Do	14	do	158,350	Power	Alco.
Do	20	do	142,000	Hand	
Do	19	do	142,000	Power	Alco E.
Do	10	Switch	175,200	do	Do.
1907 M. & O.	1	Road	154,600	Hand	
Do	21	Switch	145,000	do	
Do	10	do	163,500	Power	Alco.
Do	13	do	164,000	do	Do.
Do	10	Road	164,600	do	Do.
Do	4	Switch	142,000	Hand	
Do	12	Road	215,700	Power	Alco.
Do	9	do	215,700	Hand	
Do	10	do	218,500	Power	Alco.
Do	13	do	219,400	do	Lewis.
Do	4	do	218,400	do	Alco.
Do	5	do	217,700	do	Do.
Do	5	do	224,500	do	Do.
Do	7	do	192,800	do	Do.
Do	8	do	191,500	do	Do.
Montour	12	Road	258,000	Power	Franklin.
Do	4	do	280,000	do	Do.
Do	2	do	245,000	do	Alco.
Do	4	do	173,200	Hand	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
N. C. & St. L.	7	Road	150, 400	Power	Ragonnet.
Do.	3	Switch	137, 000	Hand	
Do.	2	do	137, 000	Power	Ragonnet.
Do.	2	do	137, 000	Hand	
Do.	2	do	134, 000	Power	1 Ragonnet; 1 Lewis.
Do.	4	do	134, 900	do	Ragonnet.
Do.	3	do	134, 900	Hand	
Do.	4	Road	144, 000	Power	Ragonnet.
Do.	6	Switch	144, 000	do	Do.
Do.	25	Road	153, 300	do	Do.
Do.	5	Switch	153, 300	do	Do.
Do.	6	do	150, 300	do	Do.
Do.	4	do	166, 000	do	Do.
Do.	1	Road	166, 000	do	Do.
Do.	8	Switch	192, 100	do	Do.
Do.	2	Road	192, 100	do	Do.
Do.	8	do	150, 000	do	Do.
Do.	8	do	165, 500	do	Do.
Do.	5	do	224, 500	do	Precision.
Do.	3	do	217, 970	do	Do.
Do.	5	do	224, 000	do	Do.
Do.	5	do	220, 000	do	Alco.
Do.	29	do	213, 000	do	1 Alco; 28 Ragonnet.
Do.	6	do	220, 000	do	Precision.
Do.	4	do	226, 000	do	Do.
Do.	12	do	226, 600	do	Do.
Do.	1	Switch	130, 000	do	Ragonnet.
Do.	1	do	130, 000	Hand	
Do.	2	do	135, 000	do	
Do.	2	do	135, 000	Power	Ragonnet.
Do.	1	do	169, 500	do	Do.
Do.	1	do	169, 500	Hand	
Do.	1	do	154, 000	Power	Ragonnet A.
Do.	3	Road	430, 000	do	Do.
Do.	5	Switch	179, 500	do	Do.
1908 Nevada Northern	1	Road	155, 000	Hand	
New Orleans G. N.	3	Road	191, 000	Power	Ragonnet.
Do.	2	Switch	132, 000	Hand	
Do.	3	do	176, 000	Power	Ragonnet E.
N. Y. C.	3	Switch	133, 000	Hand	
Do.	4	do	163, 500	do	
Do.	229	do	163, 500	Power	Ragonnet A.
Do.	17	do	170, 000	do	Do.
Do.	6	do	147, 000	Hand	
Do.	3	do	147, 000	Power	Ragonnet A.
Do.	32	do	152, 000	Hand	
Do.	9	do	152, 000	Power	Ragonnet A.
Do.	6	do	152, 000	Hand	
Do.	29	do	152, 000	Power	Ragonnet A.
Do.	13	do	133, 000	Hand	
Do.	28	Road	159, 300	do	
Do.	57	do	159, 300	do	
Do.	1	do	159, 300	Power	Precision.
Do.	4	do	178, 400	Hand	
Do.	89	do	213, 900	do	
Do.	29	do	213, 900	Power	Ragonnet B.
Do.	17	do	161, 500	Hand	
Do.	7	do	215, 000	Power	Ragonnet B.
Do.	15	do	216, 300	Hand	
Do.	1	do	216, 300	Power	Ragonnet B.
Do.	10	do	216, 300	Hand	
Do.	25	do	215, 000	do	
Do.	30	do	215, 000	Power	Ragonnet B.
Do.	8	do	215, 000	Hand	
Do.	3	do	154, 000	do	
Do.	2	do	154, 000	do	
Do.	5	do	228, 990	Power	Precision.
Do.	33	do	217, 400	do	Do.
Do.	12	do	216, 200	Hand	
Do.	185	do	217, 400	Power	Precision.
Do.	36	do	216, 200	do	Do.
Do.	162	do	216, 200	Hand	
Do.	1	do	237, 500	Power	Precision.
Do.	5	do	225, 500	do	A.S.
Do.	112	do	225, 500	do	Ragonnet B.
Do.	1	do	225, 500	do	Precision.

Exhibit No. 58—Continued

R.R. initials		No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
N.Y.C.—Continued		8	Road	245,000	Hand	
Do		105	do	252,500	Power	Precision.
Do		115	do	186,300	do	Do.
Do		85	do	189,300	do	2 A.S.; 83 Precision.
Do		65	do	175,000	do	Precision.
Do		9	do	175,000	Hand	
Do		2	do	193,100	Power	A.S.
Do		1	do	193,100	do	Alco.
Do		107	do	193,100	do	Precision.
Do		1	do	173,400	do	Alco.
Do		67	do	173,400	do	Precision.
Do		5	do	173,400	Hand	
Do	1909	15	do	184,800	Power	Precision.
Do		1	do	172,600	do	Ragonnet A.
Do		3	do	172,600	do	Barco.
Do		44	do	172,600	do	Precision.
Do		108	do	172,600	Hand	
Do		9	do	180,500	Power	Precision.
Do		1	do	178,100	do	Do.
Do		3	do	170,500	do	Do.
Do		29	do	170,500	Hand	
Do		10	do	247,100	Power	Barco.
Do		113	do	247,100	do	1 Standard Precision.
Do		59	do	243,000	do	Precision.
Do		1	do	246,340	do	Do.
Do		1	do	241,600	do	Alco E.
Do		2	do	244,000	do	Do.
Do		99	do	242,000	do	Precision F.
Do		100	do	345,800	do	Do.
Do		50	do	245,000	do	Precision F-1.
Do		13	Switch	277,000	do	Ragonnet.
Do		1	do	273,000	do	Do.
Do		1	do	361,000	do	Mellin.
Do		1	Road	296,500	do	Ragonnet A.
Do		34	do	315,800	do	Ragonnet A.
Do		1	do	315,800	do	Barco.
Do		25	do	315,800	do	Mellin.
Do		6	Switch	466,600	do	Ragonnet.
Do		6	do	466,600	do	Mellin.
Do		23	do	239,500	do	Ragonnet A.
Do		179	do	217,500	do	Ragonnet A.
Do		15	do	217,900	do	Ragonnet A.
Do		177	do	217,900	do	Ragonnet B.
Do		5	do	134,500	Hand	Ragonnet.
Do		5	do	139,409	do	
N. Y. C. & St. L.		2	Switch	160,000	Hand	
Do		5	Road	170,900	do	
Do		15	do	178,500	do	
Do		25	do	171,000	do	
Do		5	do	172,000	do	
Do		1	Switch	169,000	do	
Do		10	Road	161,700	do	
Do		23	do	182,640	do	
Do		6	Switch	153,100	do	
Do		5	Road	150,600	do	
Do		3	do	157,500	do	
Do		3	do	157,500	Power	Ragonnet.
Do		61	do	238,100	do	Precision.
Do		25	do	220,000	do	Do.
Do		35	do	220,980	do	Do.
Do		8	do	175,500	do	Do.
Do		4	do	158,000	do	Do.
Do		6	do	155,000	do	Do.
Do		10	do	210,550	do	Ragonnet.
Do		10	do	215,730	do	Do.
Do		3	do	208,830	Hand	
Do		2	do	208,830	Power	Ragonnet.
Do	1910	5	Switch	217,000	do	Ragonnet.
Do		3	do	218,775	do	Lewis.
Do		10	do	216,500	do	Ragonnet.
Do		10	do	221,000	do	Do.
Do		33	do	173,000	do	Do.
Do		10	do	155,000	do	Do.
Do		1	do	160,230	Hand	
Do		19	do	160,230	do	6 Ragonnet; 13 Alco.
Do		1	Road	161,829	do	Ragonnet.
Do		12	do	161,829	Hand	
Do		3	do	155,500	do	
Do		3	do	155,500	Power	Ragonnet.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
N.Y.C. & St.L.—Continued.	1	Switch	142, 540	Power	Ragonnet.
Do	2	do	136, 660	Hand	
Do	6	do	140, 000	do	
N.Y., N.H. & H	38	Switch	135, 800	Hand	
Do	95	do	143, 000	do	
Do	3	do	202, 500	Power	Alco.
Do	35	do	219, 000	do	Do.
Do	16	do	247, 000	do	
Do	50	Road	159, 000	Hand	
Do	6	do	161, 000	do	
Do	50	do	176, 600	Power	Ragonnet.
Do	10	do	184, 000	Hand	
Do	5	do	184, 000	Power	Lewis.
Do	25	do	185, 850	do	Ragonnet A.
Do	8	do	240, 000	Power	Do.
Do	5	do	227, 480	do	Barco.
Do	5	do	224, 500	do	Lewis.
Do	39	do	230, 500	do	Ragonnet.
Do	1	do	243, 500	do	Do.
Do	7	do	246, 000	do	Barco B.
Do	3	do	256, 000	do	Do.
Do	10	do	260, 000	do	Do.
Do	50	do	295, 350	do	Ragonnet.
N.Y.O.&W	6	Road	150, 000	Hand	
Do	9	do	149, 000	do	
Do	7	Switch	161, 000	do	
Do	20	do	178, 000	do	
Do	15	Road	151, 000	do	
Do	18	do	184, 000	do	
Do	8	do	184, 000	Power	1 Barco; 7 Ragonnet.
Do	7	do	293, 000	do	Alco.
Do	5	do	293, 000	do	1 Precision; 4 Ragonnet.
Do	10	do	208, 200	do	Alco.
Do	10	do	239, 500	do	Do.
N.W	7	Road	165, 585	Hand	
Do	3	Switch	165, 585	do	
Do	37	Road	168, 000	do	
Do	5	do	196, 300	Screw	
Do	9	do	236, 000	Power	Ky.
Do	7	do	236, 000	do	Ragonnet.
Do	10	do	243, 000	do	Lewis.
Do	12	do	243, 000	do	Ragonnet.
Do	10	do	275, 400	do	Franklin.
Do	134	do	168, 000	Hand	
Do	27	do	222, 000	do	
Do	34	Switch	222, 000	Power	Lewis.
1911 Do	1	do	147, 300	Hand	
Do	39	Road	157, 850	do	
Do	52	Switch	157, 850	do	
Do	12	do	186, 900	do	
Do	5	do	376, 800	Power	2 Ky.; 3 Alco.
Do	26	Road	472, 000	do	6 Alco.; 20 Ky.
Do	5	Switch	472, 000	do	Ky.
Do	80	Road	578, 000	do	Franklin.
Do	10	do	508, 500	do	Do.
Do	10	do	522, 850	do	Do.
Do	15	do	354, 500	do	Ragonnet.
Do	72	do	354, 500	do	Alco.
Do	30	Switch	354, 500	do	Ragonnet
Do	72	do	377, 725	do	Do.
N.P	12	Road	260, 000	Power	Precision
Do	3	Switch	137, 000	Hand	
Do	4	do	214, 000	Power	Brown.
Do	20	do	217, 600	do	Ragonnet.
Do	67	do	149, 000	Hand	
Do	20	do	154, 200	do	
Do	10	do	152, 000	do	
Do	2	Road	152, 800	do	
Do	21	do	150, 000	do	
Do	2	do	153, 500	do	
Do	2	do	155, 100	do	
Do	9	do	196, 300	Power	Precision.
Do	1	do	197, 300	do	Do.
Do	4	do	198, 700	do	Do.
Do	6	do	199, 700	do	Do.
Do	4	do	190, 800	do	Do.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
N.P—Continued	5	Road	191,900	Power	Precision.
Do	6	do	199,900	do	Do.
Do	5	do	193,500	do	Do.
Do	61	do	153,500	Hand	
Do	18	do	156,000	do	
Do	3	Switch	153,000	Power	Ragonnet.
Do	14	do	156,000	do	Do.
Do	2	Road	203,000	Hand	
Do	130	do	206,000	do	
Do	12	do	207,700	do	
Do	10	do	208,900	Power	Ragonnet.
Do	34	do	207,000	Hand	
Do	3	do	208,900	do	
Do	2	do	210,100	do	
Do	14	do	214,500	do	
Do	4	do	217,500	do	
Do	33	do	245,800	Power	Alco E.
Do	15	do	246,500	do	Do.
Do	6	do	247,100	do	Do.
Do	41	do	247,000	do	Do.
Do	9	do	248,300	do	Do.
Do	3	do	247,800	do	Do.
Do	6	do	248,700	do	Do.
Do	8	do	249,000	do	Do.
Do	3	do	249,500	do	Do.
1912 Do	6	do	249,900	do	Alco E.
Do	6	do	204,000	do	Ragonnet.
Do	9	do	251,200	do	Alco E.
Do	2	do	252,300	do	Do.
Do	6	do	252,500	do	Do.
Do	3	do	254,900	do	Do.
Do	1	do	256,200	do	Do.
Do	3	do	255,600	do	Do.
Do	1	do	256,900	do	Do.
Do	27	Switch	172,500	Hand	
Do	1	Road	172,000	do	
Do	27	do	176,400	do	
Do	14	Switch	183,000	do	
Do	1	Road	172,000	do	
Do	7	do	178,500	do	
Do	3	do	316,100	Power	Alco G.
Do	6	do	262,350	do	Ragonnet A.
Do	5	do	401,700	do	Do.
Do	10	do	406,400	do	Do.
Do	5	do	409,000	do	Alco E.
Do	6	do	419,500	do	Do.
Do	4	do	486,000	do	Do.
Do	1	do	553,000	do	Alco G.
Do	11	do	558,900	do	Do.
Northwestern Pacific	3	Switch	133,800	Hand	
Long Is. R.R.	6	Road	150,500	Hand	
Do	2	do	180,900	do	
Do	13	do	180,900	Power	Alco.
Do	19	do	223,000	do	Do.
Do	31	do	178,000	do	Do.
Do	1	Switch	136,250	Hand	
Do	4	do	203,000	Power	1 Alco; 3 Ragonnet.
Do	15	do	208,700	do	2 Ragonnet; 13 Alco.
Pa. R.R.:					
A. & B.B	4	Switch	198,400	Power	Alco.
Western A	4	Road	223,000	Hand	
Do	2	do	223,000	Screw	
Do	1	do	175,700	Hand	
Ind. Un. Ry	2	Switch	132,500	do	
Do	3	do	157,250	do	
Do	4	do	170,000	Power	Alco.
Do	5	do	214,000	do	Do.
Do	1	do	219,000	do	Do.
Do	1	do	219,000	do	Do.
Do	4	do	228,220	do	Do.
1912A Pa. R.R	1	Road	408,700	do	Ragonnet.
Do	10	do	458,150	do	Do.
Do	257	do	175,700	Hand	
Do	15	do	178,700	do	
Do	75	do	177,900	do	
Do	517	do	180,900	do	
Do	1	do	209,800	do	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Pa. R.R.—Continued	3	Road	211, 000	Hand	
Do	12	do	210, 900	do	
Do	10	do	214, 500	do	
Do	10	do	217, 600	do	
Do	34	do	219, 500	do	
Do	1	do	219, 500	Power	Alco.
Do	3	do	225, 000	do	Alco.
Do	24	do	225, 000	Screw	
Do	67	do	225, 000	Hand	
Do	64	do	225, 000	do	
Do	4	do	211, 000	do	
Do	2	do	211, 000	Screw	
Do	319	do	223, 300	do	
Do	30	do	223, 300	Power	Alco.
Do	181	do	223, 300	Hand	
Do	1	do	210, 575	Screw	
Do	12	do	210, 575	Hand	
Do	9	do	216, 450	do	
Do	78	do	223, 000	Screw	
Do	331	do	223, 000	Hand	
Do	9	do	352, 500	Screw	
Do	589	do	352, 500	Power	Alco.
Do	569	do	240, 200	Screw	
Do	5	do	240, 200	Power	3 Alco, 1 Precision, 1 Pittsburgh.
Do	5	do	220, 000	Power	Lewis.
Do	201	do	267, 000	Power	Alco.
Do	100	do	271, 000	Power	50 Alco, 50 Precision.
Do	60	do	351, 000	Power	Ragonnet.
Do	130	do	297, 000	Power	35 Ragonnet, 92 Lewis, 3 Mellin.
Do	90	do	178, 000	Power	Alco.
Do	112	do	188, 000	Screw	
Do	31	do	188, 000	Hand	
Do	15	do	191, 000	do	
Do	52	do	191, 000	Screw	
Do	2	do	192, 500	do	
Do	23	do	196, 300	do	
Do	2	do	196, 300	Hand	
Do	199	do	201, 830	Screw	
Do	226	do	201, 830	Power	216 Alco, 10 Precision.
1912 B Do	2	do	208, 370	Power	1 Alco, 1 Precision.
Do	1	do	182, 100	Hand	
Do	41	Switch	131, 750	Hand	
Do	6	do	131, 750	Power	Alco.
Do	9	do	170, 000	Hand	
Do	70	do	170, 500	do	
Do	55	do	180, 700	do	
Do	141	do	180, 300	do	
Do	97	do	180, 300	Power	Alco.
Do	136	do	143, 450	Hand	
Do	24	do	167, 700	do	
Do	30	do	167, 200	Power	11 Alco, 18 Mellin, 1 Ragonnet.
Do	4	do	135, 000	Hand	
Do	90	do	278, 000	Power	Alco.
P. & P. U	2	Switch	140, 000	Hand	
Do	3	do	149, 000	do	
Do	8	do	160, 500	do	
Do	6	do	169, 000	Power	Ragonnet.
Do	10	do	223, 900	do	Do.
Pere M	8	Road	154, 500	Hand	
Do	5	do	152, 000	do	
Do	13	do	159, 000	do	
Do	7	do	153, 000	do	
Do	6	do	150, 000	do	
Do	7	do	162, 000	do	
1913 Do	9	do	154, 500	do	
Do	14	Switch	132, 000	do	
Do	14	do	136, 000	do	
Do	12	Road	155, 500	do	
Do	25	do	193, 500	do	
Do	5	do	156, 000	do	
Do	25	do	210, 500	do	
Do	10	do	220, 000	Power	Ragonnet & Mellen.
Do	14	do	220, 000	do	Lewis.
Do	16	do	220, 000	do	Ragonnet.
Do	10	do	230, 500	do	Precision.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Pere M.—Continued	5	Road	242,900	Power	Precision.
Do	15	do	264,000	do	Ragonnet B.
Do	2	do	293,560	do	Do.
Do	10	Switch	204,000	do	Do.
Do	20	do	206,500	do	Do.
Do	10	do	220,600	do	Do.
Do	15	do	240,000	do	Alco.
P. & L.E	58	Switch	153,000	Hand	
Do	2	do	178,200	do	
Do	25	do	230,000	Power	Ragonnet.
Do	17	Road	170,000	Hand	
Do	14	do	170,000	do	
Do	12	do	177,880	do	
Do	19	do	177,880	Power	Ragonnet.
Do	20	do	239,000	do	Do.
Do	2	Switch	468,000	do	Do.
Do	1	do	172,600	Hand	
Do	20	Road	243,900	Power	Precision.
Do	30	do	250,000	do	Lewis.
Do	10	do	248,000	do	Precision.
Do	11	do	246,000	do	Do.
Do	9	do	160,000	Screw	
Do	5	do	160,000	do	
Do	10	do	186,700	Power	Precision.
Do	10	do	185,000	do	Do.
P. & M	12	Road	180,500	Hand	
Do	6	do	180,200	do	
Do	4	do	178,950	do	
P.S. & M	2	Switch	140,000	Hand	
Do	27	Road	180,180	do	
Quebec Central	4	Road	168,500	Hand	
Do	6	do	172,000	do	
Do	1	Switch	145,000	Power	Franklin.
Reading	36	Switch	162,100	Hand	
Do	3	do	154,125	do	
Do	7	do	156,000	do	
Do	20	do	169,800	Power	Ragonnet.
Do	10	do	177,710	Hand	
Do	26	do	155,600	do	
Do	10	do	280,610	Power	5 Alco; 5 Ragonnet.
Do	30	Road	176,925	do	5 Alco; 25 Ragonnet.
Do	5	do	172,210	do	Ragonnet.
Do	5	do	192,540	do	Do.
Do	3	do	169,225	Hand	
Do	3	do	171,475	do	
Do	15	do	177,725	do	
Do	19	do	152,650	do	
Do	30	do	203,975	do	
1914 Do	78	do	211,150	do	
Do	9	do	208,275	do	
Do	20	do	251,920	Power	Ragonnet A.
Do	80	do	257,600	do	Ragonnet.
Do	50	do	284,190	do	Do.
Do	4	Switch	183,500	Hand	
Do	11	Road	353,050	Power	Alco.
Do	1	do	187,175	do	Do.
Do	13	do	169,000	Hand	
Do	10	do	161,375	do	
Do	5	do	152,900	do	
Do	2	do	169,437	do	
Do	39	do	249,702	Power	Ragonnet.
Do	17	do	248,734	do	Do.
Do	3	Switch	248,734	do	Do.
Do	19	Road	435,500	do	Do.
Do	1	do	447,500	do	Do.
R. F. & P	7	Switch	150,226	Power	Lewis.
Do	5	do	145,975	do	Do.
Do	2	do	131,500	do	Do.
Do	2	do	156,700	do	Do.
Do	8	do	170,000	do	Do.
Do	4	do	229,000	do	Do.
Do	2	do	257,000	do	Do.
Do	6	Road	159,000	do	Do.
Do	5	do	151,200	do	Do

Exhibit No. 58—Continued

	R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
	R. F. & P.—Continued	8	Road	161,200	Power	Lewis.
	Do	5	do	161,500	do	Do.
	Do	12	do	199,000	do	Do.
	Do	4	do	205,300	do	Do.
	Do	6	do	206,000	do	Do.
	Do	4	do	262,000	do	Do.
	Rutland	3	Switch	137,000	Hand	
	Do	1	do	144,000	Power	Ragonnet A.
	Do	2	do	214,000	do	Alco.
	Do	18	Road	187,600	Hand	
	Do	6	do	220,000	Power	Alco.
	Do	10	do	156,600	do	Alco.
	Do	3	do	170,500	do	Do.
	Do	3	do	175,500	do	Do.
1915	St. L.-S.F.	2	Road	296,000	Power	Ragonnet E.
	Do	8	do	318,160	Power	Ragonnet E.
	Do	1	do	318,160	Power	Ragonnet A.
	Do	49	do	318,160	Power	Ragonnet E.
	Do	2	do	154,500	Hand	
	Do	2	Switch	166,100	Power	Lewis.
	Do	4	do	154,000	Power	Ragonnet A.
	Do	10	do	155,500	Power	Ragonnet A.
	Do	9	do	160,100	Power	Ragonnet A.
	Do	1	do	160,100	Power	Ragonnet A.
	Do	20	Road	159,200	Hand	
	Do	9	do	190,000	Power	Ragonnet E.
	Do	1	do	190,000	Power	Ragonnet E.
	Do	26	Switch	178,000	Power	Ragonnet A.
	Do	5	do	187,000	Power	Ragonnet A.
	Do	13	Road	187,000	Hand	
	Do	22	Switch	187,000	Power	Ragonnet A.
	Do	8	Switch	212,500	Power	Ragonnet A.
	Do	32	Road	212,500	do	Do. Do.
	Do	31	do	211,000	Hand	
	Do	5	do	226,400	do	
	Do	4	do	224,450	do	
	Do	4	do	233,700	Power	Ragonnet B, modified.
	Do	1	do	235,260	do	Ragonnet E.
	Do	11	do	233,700	do	Do. Do.
	Do	4	do	233,700	do	Do. Do.
	Do	10	do	245,170	do	Do. Do.
	Do	20	do	185,000	do	Do. A.
	Do	13	do	261,780	do	Do. E.
	Do	15	do	266,050	do	Do. E.
	Do	20	do	274,690	do	Do. E.
	Do	6	do	360,000	do	Alco.
	Do	8	Switch	141,500	Hand	
	Do	5	do	148,700	do	
	Do	10	do	154,500	do	
	Do	12	do	155,200	do	
	Do	7	do	163,500	Power	Mellin.
	Do	4	Road	223,700	do	Barco B-3.
	Do	1	do	220,000	do	Ragonnet E.
	Do	1	do	220,000	do	Barco B-3.
	Do	23	do	223,700	do	Lewis.
	Do	4	do	220,000	do	Do.
	Do	35	do	259,000	do	Ragonnet E.
	Do	2	do	257,880	do	Do. Do.
	St. L. S.W	6	Road	156,400	Hand	
	Do	10	Switch	138,000	Power	Alco.
	Do	5	do	140,000	do	Do.
	Do	4	do	177,000	do	Do.
	Do	3	do	213,500	do	Do.
	Do	5	Road	178,000	do	Do.
	Do	2	do	175,000	Power 1, Hand 1	Do.
	Do	8	do	182,000	Power 6, Hand 2	Do.
	Do	2	do	180,800	Power 1, Hand 1	Do.
1916	Do	8	Road	186,000	Power 2, Hand 6	Alco.
	Do	2	Switch	213,500	Power	Do.
	Do	10	Road	209,000	do	Alco 9; all service 1.
	Do	8	do	209,000	do	Alco 7; all service 1.
	Do	2	do	209,000	Power 0, Hand 0	Alco.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
St. L.S.W—Continued	8	Road	209,000	Power 0. Hand 0.	Alco.
Do	10	do	211,000	Power	Do.
Do	2	do	215,600	do	Do.
Do	10	do	171,000	Power 0. Hand 0.	Do.
Do	8	do	172,000	Power	Do.
Do	21	do	212,300	do	Ragonnet.
Do	3	do	213,745	do	Do.
Do	12	do	213,745	do	Do.
Do	10	do	242,500	do	Alco.
S. & Atlanta	5	Road	160,000	Power	Ragonnet.
Do	2	do	178,000	do	Alco.
Do	2	Switch	133,000	Hand	
S. A. L	10	Road	260,000	Power	Ragonnet.
Do	15	do	276,000	do	Do.
Do	20	do	185,000	do	Precision.
Do	1	do	185,000	Screw	
Do	2	do	185,000	Power	Ragonnet.
Do	6	do	190,000	do	Do.
Do	8	do	190,000	do	Alco.
Do	10	Switch	165,000	do	Do.
Do	50	do	180,000	do	Ragonnet.
Do	24	do	144,280	Hand	
Do	1	do	144,280	Power	Lewis.
Do	4	do	144,280	Hand	
Do	1	do	144,280	Power	Lewis.
Do	19	Road	207,500	Hand	
Do	15	do	209,000	Power	Alco.
Do	10	do	220,000	do	Ragonnet.
Do	43	do	212,000	do	Alco.
Do	73	do	212,000	do	Precision.
Do	5	do	210,500	do	Lewis.
Do	4	do	210,500	do	Alco.
Do	6	do	210,500	do	Ragonnet.
Do	10	do	209,000	do	Alco.
Do	10	do	213,000	do	Do.
Do	26	do	213,000	do	Precision.
Do	7	do	150,190	Hand	
Do	10	do	159,340	do	
Do	10	do	191,000	do	
Do	9	do	191,000	do	
Do	1	do	189,520	do	
Do	4	do	156,000	Power	Ragonnet.
1917 Sou. Pac	5	Road	394,700	Power	Ragonnet A.
Do	1	do	398,500	do	Do. Do.
Do	1	do	395,300	do	Do. Do.
Do	1	do	395,300	do	Alco G.
Do	2	do	400,760	do	Do.
Do	32	do	440,800	do	Do.
Do	6	do	440,800	do	Ragonnet A.
Do	1	do	440,800	do	Barco B-4.
Do	10	do	475,200	do	Alco H.
Do	16	do	482,500	do	Alco H.
Do	25	do	517,000	do	Alco H.
Do	1	do	320,100	do	Alco G.
Do	5	do	320,100	do	Alco E.
Do	2	do	320,100	do	Alco H.
Do	4	do	320,100	do	Ragonnet A.
Do	1	Switch	172,000	do	Sheedy.
Do	1	Road	180,000	do	Do.
Do	10	Switch	180,000	do	Do.
Do	6	do	176,000	do	Do.
Do	6	do	183,200	do	Do.
Do	2	Road	180,000	do	Do.
Do	2	do	180,000	Hand	
Do	1	Switch	180,000	do	
Do	25	do	180,000	Power	Sheedy.
Do	5	Road	187,000	do	Ragonnet A.
Do	8	do	187,000	do	Sheedy.
Do	7	do	187,000	Hand	
Do	2	Switch	187,000	do	
Do	2	do	187,000	Power	Ragonnet A.
Do	2	do	187,000	do	Sheedy.
Do	1	Road	178,000	do	Do.
Do	1	Switch	178,000	do	Ragonnet A.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Sou. Pac—Continued	2	Switch	178,000	Power	Sheedy.
Do	2	Road	185,000	do	Ragonnet A.
Do	2	do	185,000	do	Sheedy.
Do	3	do	185,000	Hand	
Do	1	Switch	185,000	Power	Ragonnet A.
Do	1	do	185,000	do	Sheedy.
Do	1	do	185,000	Hand	
Do	46	Road	191,900	do	
Do	1	do	197,900	do	
Do	1	Switch	193,700	do	
Do	153	Road	193,700	do	
Do	34	do	199,700	do	
Do	1	do	152,000	do	
Do	1	Switch	164,000	do	
Do	2	Road	160,000	do	
Do	1	do	169,500	do	
Do	3	Switch	169,500	do	
Do	2	do	169,500	Power	Ragonnet A.
Do	1	Road	161,000	do	Do. Do.
Do	1	Switch	161,000	Hand	
Do	1	do	161,000	Power	Do. Do.
Do	6	Road	177,800	Hand	
Do	5	Switch	177,800	do	
Do	2	do	177,800	Power	Do. Do.
Do	2	do	177,800	Hand	
Do	1	do	164,000	do	
1918 Do	1	do	164,000	Power	Ragonnet A.
Do	20	Road	273,000	do	Do. Do.
Do	15	do	307,400	do	Do. B.
Do	32	do	306,100	do	Do. B.
Do	18	do	318,900	do	Do. B.
Do	36	do	306,100	do	Alco E.
Do	5	do	306,400	do	Alco E.
Do	1	do	313,900	do	Do.
Do	10	do	262,000	do	Alco G.
Do	55	do	150,400	Hand	
Do	2	Switch	150,400	do	
Do	3	Road	159,000	do	
Do	1	Switch	159,000	do	
Do	3	Road	153,100	do	
Do	14	do	159,000	do	
Do	1	Switch	159,000	do	
Do	15	Road	150,000	do	
Do	2	do	161,600	do	
Do	2	do	155,800	do	
Do	1	do	152,000	Power	Ragonnet A.
Do	1	do	153,000	Hand	
Do	1	do	153,000	Power	Do. Do.
Do	1	Switch	153,000	do	Do. Do.
Do	2	Road	161,600	do	Do. Do.
Do	41	do	206,200	do	Do. Do.
Do	16	do	210,400	do	Do. Do.
Do	1	do	232,900	do	Do. Do.
Do	7	do	209,700	do	Do. Do.
Do	5	do	209,700	do	Alco G.
Do	7	do	209,700	Screw	
Do	1	do	232,900	Power	Alco G.
Do	8	do	246,800	do	Ragonnet A.
Do	5	do	246,800	do	Do. Do.
Do	8	do	246,800	do	Alco E.
Do	4	do	257,400	do	Do.
Do	51	do	246,000	do	Do.
Do	26	do	246,000	do	Alco G.
Do	6	do	262,500	do	Barco B.
Do	2	do	152,000	Hand	
Do	3	do	160,200	Power	Ragonnet A.
Do	4	do	163,400	do	Do.
Do	2	do	150,400	Hand	
Do	8	do	155,000	Power	Ragonnet A.
Do	2	do	155,000	do	Sheedy.
Do	6	do	172,400	Power	Ragonnet A.
Do	2	do	171,000	do	Do. Do.
Do	1	do	180,000	do	Do. B.
Do	13	do	180,700	do	Do. Do.
Do	1	do	183,100	do	Do. Do.
Do	6	do	180,700	do	Alco E.
Do	8	do	183,100	do	Do.
Do	10	do	157,500	Hand	
Do	10	do	189,300	Power	Ragonnet A.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
1919 Sou. Pac.—Continued	24	Switch	131,250	Hand	
Do	5	do	135,700	do	
Do	10	do	150,000	do	
Do	75	do	140,000	do	
Do	15	do	145,000	do	
Do	29	do	154,600	do	
Do	10	do	147,900	do	
Do	38	do	153,000	do	
Do	10	do	155,000	Power	Alco E.
Do	1	do	138,000	Hand	
Do	1	do	134,700	do	
Do	12	do	153,000	do	
Do	1	do	134,800	do	
Do	1	do	177,400	Power	Brown.
Do	3	do	177,400	Hand	
Do	6	do	229,000	Power	Ragonnet A.
Do	16	Road	316,000	do	Alco E.
Do	23	do	317,500	do	Do.
Do	10	do	317,500	do	Alco G.
Do	18	do	152,000	Hand	
Do	42	do	162,000	do	
Do	8	do	162,000	do	
Do	22	do	173,900	do	
Do	3	Switch	147,000	do	
Do	1	do	155,000	Power	Ragonnet A.
Do	7	Road	161,100	Hand	
Do	1	Switch	161,100	do	
Southern Ry	19	Road	151,000	Hand 9 Power 10	Alco 8; Pitts. 1; Brown 1.
	92	do	152,000	Hand 39 Power 53	Alco 48; Rag. 3; Lewis 2.
Do	414	do	182,000	Hand 46 Power 368	Alco 326; Ragonnet 39; Lewis 2; Hunter 1.
Do	10	do	217,500	do	Alco.
Do	5	do	189,000	do	Alco.
Do	3	do	332,700	Power	Ragonnet.
Do	21	do	374,000	do	Alco 9; Ragonnet 12.
Do	3	do	390,000	do	Alco.
Do	182	do	215,700	Hand 12 Power 170	Alco 160; Rag. 10.
Do	25	do	220,000	Power	Alco 18; Rag. 7.
Do	170	do	239,500	do	Alco 167; Rag. 3.
Do	5	do	160,000	do	Alco.
Do	45	do	221,500	do	Alco 44; Rag. 1.
Do	80	do	294,400	do	Alco 10; Rag. 70.
Do	46	do	276,000	do	Ragonnet.
Do	8	do	409,000	do	Alco.
Do	64	do	180,000	do	Alco.
Do	30	do	209,800	do	Alco 21; Rag. 9.
Do	25	do	234,500	do	Alco.
1920 Do	18 143	Switch	145,000	Hand Power	104 Alco; 31 Rag.; 7 Lewis; 1 Hunter.
Do	78	do	214,000	Power	Alco 67; Rag. 5; Sou. 2; Lewis 1; Brown 3.
Do	10	do	208,700	do	Ragonnet.
Spokane Int	3	Road	168,000	Hand	
Do	1	Switch	161,000	do	
Do	3	Road	160,000	do	
S. P. & S	5	Switch	150,000	Hand	
Do	2	do	153,800	do	
Do	4	Road	155,000	do	
Do	1	do	150,000	do	
Do	2	do	175,000	do	
Do	5	Road	172,000	do	
Do	11	Switch	180,000	do	
Do	2	Road	161,160	do	
Do	15	do	151,000	do	
Do	4	do	229,000	Power	Precision type F.
Do	4	do	229,000	do	Ragonnet type B.
Do	1	do	207,000	do	Precision type F.
Do	1	do	240,000	do	Do.
Do	4	do	240,000	do	Do.
Do	6	do	166,500	Hand	Alco type E.
Sus. & N. Y	1	Road	186,000	Hand	
Do	1	do	190,900	do	
Do	1	do	195,400	do	
Do	1	do	205,500	Power	Ragonnet type A.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
T. & N. O.	4	Road	156, 100	Power	Ragonnet type B.
Do.	5	do	200, 000	Hand	
	12	do	200, 000	Power	Rag. type E 1; Rag. type B 11.
Do.	4	do	181, 100	Hand	
Do.	4	do	203, 700	Power	Barco type B4.
Do.	2	Switch	208, 400	do	Ragonnet type B.
Tenn. Cent.	4	Road	180, 500	Power	Alco.
Do.	8	do	158, 000	do	Do.
Do.	4	do	221, 000	do	Do.
Do.	1	Switch	133, 000	Hand	
Do.	1	do	145, 000	Power	Alco.
Do.	1	do	152, 700	do	Do.
Do.	1	do	152, 700	Hand	
T. R.R. A. of St. L.	33	Switch	142, 600	Hand	
Do.	4	do	143, 600	do	
Do.	6	do	149, 200	do	
Do.	10	do	145, 800	do	
Do.	1	do	150, 200	do	
Do.	19	do	136, 000	do	
Do.	10	do	183, 500	do	
Do.	15	do	201, 000	do	
Do.	11	do	202, 000	do	
Do.	1	do	202, 000	Power	Alco G.
Do.	10	do	204, 000	Hand	
Do.	10	do	165, 000	Power	Alco D4.
Do.	15	do	203, 000	do	Alco E.
Do.	17	do	252, 500	do	Ragonnet B.
Do.	2	do	247, 500	do	Do. B.
1921 Do.	6	do	247, 500	do	Alco G.
Do.	10	do	262, 360	do	Do.
Tex. & N.O.	5	Road	210, 000	Power	Ragonnet.
Do.	5	do	213, 000	do	Do.
Do.	8	do	214, 000	do	Do.
Do.	2	Switch	152, 000	Hand	
Do.	8	Road	152, 000	do	
Do.	2	do	170, 000	do	
Do.	2	Switch	190, 000	Power	Alco type G.
Do.	33	Road	190, 000	Hand	
Do.	16	do	194, 000	do	
Do.	1	Switch	221, 000	do	
Do.	2	Road	221, 000	do	
Do.	6	do	273, 000	Power	Ragonnet.
Do.	7	do	274, 000	do	Do.
Do.	32	do	278, 000	do	Do.
Do.	10	do	306, 000	do	Alco type E.
Do.	15	Switch	131, 250	Hand	
Do.	27	do	140, 000	do	
Do.	20	do	145, 000	do	
Do.	8	do	154, 600	do	
Do.	4	do	150, 000	do	
Do.	10	do	155, 100	Hand	
	20		155, 100	Power	Alco Type E 10; Sheedy-Lock 10.
Do.	6	do	232, 380	do	Ragonnet.
Do.	12	Road	163, 000	do	Ragonnet type E.
Do.	12	do	176, 000	do	Ragonnet.
Do.	8	do	183, 000	do	Rag. type E.
Do.	1	do	183, 000	do	Do. Do.
Do.	3	do	189, 000	do	Alco type G.
Do.	3	do	262, 000	do	Do. Do.
Do.	1	do	262, 000	do	Do. Do.
Do.	4	do	150, 000	Hand	
Do.	13	do	152, 000	do	
Do.	3	do	153, 000	do	
	6		153, 000	Power	Ragonnet.
Do.	2	do	155, 000	Hand	
Do.	3	do	181, 000	Power	Ragonnet type E.
Do.	7	do	185, 000	do	Do. Do.
Do.	19	do	210, 000	do	Ragonnet.
Do.	20	do	214, 000	do	Do.
Tex. & Pac.	7	Switch	130, 000	Hand	
Do.	7	do	158, 700	Power	Ragonnet type A.
Do.	14	do	165, 000	do	Melline.
Do.	8	do	160, 000	do	Alco type E.
Do.	2	do	230, 870	do	Do. Do.
Do.	8	do	228, 530	do	Do. Do.

Exhibit No. 58—Continued

	R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
	Tex. & Pac—Continued	2	Switch	232,800	Power	Alco type G.
	Do	3	do	230,500	do	Do. Do.
	Do	20	Road	163,000	Hand	
	Do	5	do	163,000	Power	Sheedy Lock.
	Do	2	do	163,000	do	Alco G.
	Do	7	do	163,000	do	Alco E.
	Do	3	do	163,000	do	Ragonnet B.
	Do	1	do	163,000	do	Do. A.
	Do	2	do	163,000	do	Do. D.
	Do	10	do	182,800	Hand	
1922	Do	14	do	265,000	Power	Ragonnet type A.
	Do	12	do	265,545	do	Do. type B.
	Do	18	do	267,500	do	Do. Do.
	Do	11	do	220,000	do	Do. Do.
	Do	10	do	300,000	do	Alco type E.
	Do	60	do	300,000	do	Do. type G.
	Do	10	do	152,300	Hand	
	Do	10	do	245,500	Power	Alco type G.
	Do	7	do	173,357	do	Ragonnet type B.
	Do	7	do	182,000	do	Alco type E.
	Do	8	do	187,000	do	Do. Do.
	T. P. & Wn	2	Road	151,000	Hand	
	Do	4	do	158,350	Power	Alco type G.
	Do	2	do	161,000	do	Do. Do.
	Do	1	do	151,000	do	Do. Do.
	Do	4	do	163,500	do	Do. Do.
	Do	4	do	188,300	do	Do. Do.
	Do	2	Switch	208,000	do	T. D. Corp.
	Do	2	do	211,000	do	Alco G.
	Ton. & T	2	Road	169,700	Hand	
	T. H. & Buf	2	do	172,600	Power	Barco-Air operated.
	Do	10	Switch	166,000	do	Casey-Cavin air "
	Do	7	Road	178,800	do	Barco Do Do.
	Do	2	do	254,500	do	Do. Do.
	Do	2	Switch	142,500	Hand	
	T. H. & Buf. (correction)	15	Road	370,000	Power	Precision Type F.
	Union Pac	58	do	370,000	do	Ragonnet E "10".
	Do	15	do	372,000	do	Do. Do.
	Do	10	do	287,000	do	Precision G.
	Do	19	do	230,000	do	Ragonnet B 10.
	Do	1	do	230,000	Hand	
	Do	20	do	230,000	Power	Alco E-10.
	Do	15	do	234,100	do	Do. Do.
	Do	4	do	224,000	do	Precision D.
	Do	1	do	224,000	do	Do. F.
	Do	10	do	289,000	do	Ragonnet A-9
	Do	25	do	292,000	do	Do. B-10.
	Do	9	do	297,000	do	Alco E-10.
	Do	1	do	297,000	do	Barco-10.
	Do	7	do	293,000	do	Ragonnet B-10.
	Do	3	do	289,400	do	Precision D.
	Do	5	do	289,400	do	Precision D.
	Do	6	do	303,980	do	Ragonnet A-9.
	Do	8	do	303,980	do	Do. Do.
	Do	7	do	300,820	do	Alco E-10.
	Do	3	do	300,100	do	Ragonnet E-10.
	Do	5	do	300,100	do	Do. Do.
	Do	16	do	464,000	do	Do. Do.
	Do	14	do	464,000	do	Do. A-9.
	Do	5	do	472,000	do	Do. B-10.
	Do	5	do	472,000	do	Do. Do.
	Do	25	do	472,000	do	Do. E-10.
1923	Do	5	do	472,000	do	Do. A-10.
	Do	31	do	150,000	Hand	Alco E-10.
	Do	44	do	167,000	Power	
	Do	11	do	167,000	do	Ragonnet A-7.
	Do	9	do	167,000	do	Do. E-10.
	Do	5	do	167,000	do	Do. B-10.
	Do	1	do	167,000	do	Barco-10.
	Do	5	do	162,000	do	Alco E-10.
	Do	2	do	166,900	Hand	Ragonnet A-9.
	Do	6	do	166,900	Power	
	Do	2	do	177,500	do	Ragonnet A-7.
						Do. A-9.

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Union Pac—Continued	4	Road	179,000	Power	Do. A-7.
Do	1	do	179,000	do	Do. B-10.
Do	1	do	179,000	do	Alco E-10.
Do	40	do	221,500	do	Ragonnet B-10.
Do	31	do	206,200	do	Do. A-7.
Do	19	Switch	206,200	do	Do. Do.
Do	18	Road	210,000	do	Do. Do.
Do	4	do	208,450	do	Do. Do.
Do	13	Switch	208,450	do	Do. Do.
Do	27	Road	209,950	do	Do. Do.
Do	17	do	208,450	do	Do. Do.
Do	10	Switch	208,450	do	Do. Do.
Do	7	Road	207,000	do	Do. Do.
Do	5	do	209,950	do	Do. B-10.
Do	21	do	214,050	do	Do. A-7.
Do	13	do	215,600	do	Do. Do.
Do	10	do	214,050	do	Do. E-10.
Do	23	do	214,050	do	Barco-10.
Do	30	do	214,050	do	Ragonnet A-9.
Do	24	do	212,000	do	Do. Do.
Do	2	do	210,700	do	Do. Do.
Do	26	do	228,000	do	Do. B-10.
Do	1	do	209,300	do	Do. A-9.
Do	3	do	206,445	do	Do. Do.
Do	15	do	217,800	do	Do. A-7.
Do	1	do	211,700	do	Do. Do.
Do	1	do	214,050	do	Alco G-10.
Do	1	do	212,000	do	Do.
Do	121	do	191,100	Hand	
Do	30	Switch	191,100	do	
Do	47	do	191,100	Power	Ragonnet A-7.
Do	3	do	191,100	do	Do. B-10.
Do	29	Road	189,966	Hand	
Do	8	Switch	186,900	do	Do. A-7.
Do	4	Road	175,600	do	
Do	2	Switch	175,600	do	
Do	3	do	175,600	Power	Do. B-10.
Do	47	Road	198,460	Hand	
Do	3	Switch	198,460	do	
Do	10	do	198,460	Power	Ragonnet B-10.
Do	5	Road	183,300	Hand	
Do	64	do	162,300	do	
Do	7	Switch	162,300	do	
Do	2	do	162,300	Power	Ragonnet A-7.
Do	17	Road	171,500	Hand	
Do	3	Switch	171,500	do	
1924 Do	1	Road	167,000	Hand	
Do	4	do	167,000	do	
Do	5	do	167,000	do	
Do	2	Switch	167,000	do	
Do	14	Road	174,000	do	
Do	2	do	153,000	do	
Do	3	do	179,000	do	
Do	1	do	179,000	Power	Ragonnet A-9.
Do	3	do	172,000	Hand	
Do	2	do	172,000	do	
Do	2	do	167,040	do	
Do	1	Road	167,040	do	
Do	1	Switch	148,920	do	
Do	15	Switch	165,000	Power	Mellin 10.
Do	5	do	150,000	Hand	
Do	5	do	142,840	do	
Do	20	do	154,682	do	
Do	31	do	156,000	do	
Do	3	do	156,000	Power	Ragonnet B-10.
Do	30	do	159,000	do	Do.
Do	3	do	142,840	Hand	
Do	5	do	142,840	do	
Do	1	do	150,000	do	
Do	5	do	154,682	do	
Do	15	do	140,000	do	
Do	6	do	145,000	do	
Do	4	do	154,000	do	
Do	4	do	146,400	do	
Do	1	do	165,000	Power	Ragonnet B-10.
Do	5	do	150,000	Hand	
Do	5	do	140,000	do	
Do	3	do	145,000	do	
Do	4	do	157,000	Power	Do.

Exhibit No. 58—Continued

R.R. initials	No of Locomotive	ype of service	Weight on drivers	Kind of reverse gear	Name and type of power reverse gear
Union Pac.—Continued	1	Switch	130,000	Hand	
Do	1	do	197,000	do	
Do	1	do	200,100	do	
Do	1	do	146,800	do	
Do	8	Road	161,000	do	
Do	1	do	161,000	do	
Do	3	do	159,000	do	
Do	6	do	162,000	do	
Do	5	do	161,000	do	
Do	7	do	161,000	do	
Utah Ry	6	Road	285,500	Power	Ragonnet A-9.
Do	2	do	299,200	do	Do. B-10-A.
Do	1	do	291,480	do	Do. E-10-A.
Do	3	do	462,500	do	Do. A-9.
Do	1	Switch	136,500	Hand	
Do	1	do	136,500	do	
Do	1	do	145,000	do	
Do	1	do	174,900	do	
1925 Do	5	Switch	182,300	Hand	
Do	6	Road	189,000	Power	Lewis.
Do	6	do	174,400	Hand 2. / Power 4.	Do.
Do	15	Switch	214,050	do	Ragonnet.
Do	27	Road	214,050	do	Do.
Do	7	Switch	247,600	do	Do.
Do	11	Road	247,600	do	Do.
Do	1	do	233,810	do	Do.
Do	4	do	279,900	do	Lewis.
Do	1	do	441,080	do	Ragonnet.
Do	8	do	356,780	do	Do.
Do	6	do	479,200	do	Lewis.
Do	10	do	617,000	do	Do.
Do	1	do	487,390	do	Ragonnet.
Do	35	do	478,000	do	Lewis.
Wabash Ry	16	Switch	143,065	Hand	
Do	42	do	154,040	do	
Do	19	do	158,100	do	
Do	2	do	183,450	do	
Do	20	do	217,500	Power	Ragonnet.
Do	25	do	223,800	do	Do.
Do	67	Road	167,900	Hand	
Do	3	do	152,500	do	
Do	15	do	154,500	do	
Do	12	do	198,500	do	
	18		198,500	Power	Alco G.
Do	1	do	155,140	Hand	
	15		155,140	Power	Do.
Do	13	do	151,400	Hand	
	10		151,400	Power	Do.
Do	63	do	207,140	do	Alco G 37; old style 26.
Do	20	do	220,000	do	Ragonnet.
Do	20	do	238,000	do	Alco G.
Do	4	do	242,000	do	Do.
Do	6	do	248,500	do	Do.
Do	20	do	257,680	do	Do.
Do	10	do	251,870	do	Do.
Do	15	do	248,450	do	Do.
Do	5	do	251,215	do	Do.
Do	25	do	316,800	do	Do.
Do	25	do	270,400	do	Do.
Do	20	do	274,100	do	Do.
Do	5	do	275,390	do	Do.
Wn. Maryland	9	Road	160,500	Hand	
Do	3	do	157,600	do	
Do	1	do	157,600	do	
Do	2	Switch	157,600	do	
Do	3	Road	163,500	do	
Do	4	do	163,500	do	
Do	3	Switch	182,000	do	
Do	3	Road	182,000	do	
Do	5	do	206,000	do	
Do	30	do	215,000	do	
Do	15	do	216,000	do	

Exhibit No. 58—Continued

R.R. initials	No. of Locomotive	Type of service	Weight on driers	Kind of reverse gear	Name and type of power reverse gear
Wn. Maryland—Continued	20	Road	217,500	Hand	
Do	2	do	287,910	Power	Pittsburgh.
Do	2	do	287,910	do	Alco E.
Do	8	do	287,910	do	Ragonnet E.
1926 Do	38	do	281,910	do	Barco B4.
Do	10	do	451,800	do	Do.
Do	5	do	455,600	do	Do.
Do	10	do	459,900	do	Do.
Do	2	Switch	350,000	do	Ragonnet A.
Do	3	do	310,000	do	Do.
Do	4	do	351,700	do	Do.
Do	3	do	140,000	Hand	Do.
Do	2	do	142,500	do	
Do	5	do	164,700	do	
Do	2	do	210,700	Power	Do.
Do	1	do	221,000	do	Do.
Do	9	do	200,000	Hand	
Do	10	Road	195,200	Power	Ragonnet E.
Do	20	do	386,800	do	Barco B4.
Wn. Pacific	20	Road	185,000	Hand	
Do	45	do	184,000	do	
Do	12	Switch	145,780	do	
Do	4	do	160,000	do	
Do	10	Road	356,500	Power	Alco E.
Do	5	do	241,500	do	Alco E2.
Do	5	do	239,000	do	Lewis with Alco valve.
Do	5	do	246,000	do	Alco E.
Do	6	do	246,000	do	Do.
Do	5	do	245,000	do	Do.
Do	5	do	247,200	do	Alco E2.
Do	5	do	249,000	do	Alco G.
A. & W. Pt. Wn. Ry. of A	2	Switch	214,000	Power	Ragonnet B.
Do	1	do	142,000	do	Do. A.
Do	2	Road	154,900	do	Do. B.
Do	2	do	163,000	do	Do. B.
Do	2	do	192,500	do	Alco.
Do	2	do	209,500	do	Franklin Precision.
Do	4	do	214,000	do	Ragonnet B.
Do	7	do	225,600	do	Alco.
Wh. & Lake E	6	Switch	142,780	Hand	
Do	8	do	164,900	Power	Alco type G.
Do	5	do	214,000	do	Ragonnet type B.
Do	20	do	219,130	do	Alco type G.
Do	6	do	163,160	do	
Do	4	do	163,160	do	
Do	17	Road	187,360	do	
Do	8	Switch	187,360	do	
Do	10	Road	193,700	do	Alco type G.
Do	9	do	193,700	Hand	
Do	6	do	188,112	do	
Do	7	do	158,000	do	
Do	2	do	244,420	Power	Ragonnet type B.
Do	4	do	237,400	do	Do.
Do	6	do	239,050	do	Do.
Do	8	do	242,770	do	Do.
Do	4	do	354,750	do	Ragonnet type A.
Do	16	do	362,500	do	Do.
Do	10	do	360,000	do	Lewis.
Do	19	do	239,839	do	Do.
Do	1	do	239,839	do	Precision Franklin.
Do	7	do	158,000	Hand	
Do	2	do	244,420	Power	Ragonnet, type B.
Do	4	do	237,400	do	Do.
Do	6	do	239,050	do	Do.
Do	8	do	242,770	do	Ragonnet, type B.
Do	4	do	354,750	do	Do. A
Do	16	do	362,500	do	Do. Do.
Do	10	do	360,000	do	Lewis.
Do	19	do	239,839	do	Do.
Do	1	do	239,839	do	(Franklin) Precision.
Wnpt. & N. Br	1	Road	152,000	Hand	

1927 Exhibit 58 also shows the type of valve gear with which the respective locomotives listed therein are equipped. The following table shows the number of such locomotives equipped with the several types of valve gears listed below as set forth in exhibit 58 and shown therein as road locomotives weighing 150,000 pounds or more on drivers, and switching locomotives weighing 130,000 pounds or more on drivers:

Walscheart	24,615
Baker	9,318
Stephenson	8,424
Southern	726
Young	290
Caprotti	7
Miscellaneous and mixed	260
Total	43,640

1928 *Exhibit 59*

Exhibit no. 59 is a statement concerning an accident due to losing control of locomotive on the L. A. & S. L.

No. of locomotive: 3703.

Type of locomotive: Harriman lines standard Mikado, or 2-8-2, Schmidt superheater, working pressure 200#, oil burner, Walscheart valve gear, Ragonnet power reversing gear, ET brake equipment, with Westinghouse 8½" cross-compound air compressor.

Owned and operated by: Los Angeles & Salt Lake Railroad.

Class of service: Running light on joint track of the Atchison, Topeka & Santa Fe Ry., Coast Lines.

Left terminal: Left Summit, Cal. (9.7 miles east of point of accident) at 9:05 p.m., February 2, 1917.

Place & time of failure of main reservoir pipe: About 1 mile east of Cajon, Cal. (4.1 miles east of point of accident) at about 9:20 p.m., February 2, 1917.

Place & time of accident: 3.1 miles west of Cajon, Cal., at about 9:27 p.m., Feb. 2, 1917.

Character of track: Descending grade of 1.8% on 10-degree curve to left. Double track, west-bound traffic using left-hand track, and automatic block signals.

Names of crew: Engineer J. H. Dalzell, residence, San Bernardino, Cal.; Fireman John Davis.

Killed: Fireman John Davis.

Injured: Engineer J. H. Dalzell, right arm broken, head lacerated, and neck sprained; incapacitated about 60 days.

Estimated property damage: $2,500 to locomotive, and $500 to track; total, $3,000.

Last inspections:

Annual	10/12/16,	San	Bernardino.
All air-brake equipment	9/ 2/16,	"	"
Air gauges & orifice test	12/ 2/16,	"	"
Monthly	1/13/17,	"	"

Cause of accident: Derailment at high speed due to loss of control of locomotive.

Cause of loss of control: Broken main reservoir air pipe causing loss of all air pressure with which to operate the ET brake equipment and Ragonnet power reversing gear.

Contributory causes: Absence of sustained automatic action
1929 of ET brake equipment when main reservoir pressure fails; and inaccessibility of steam valve or obstruction in steam pipe to the Ragonnet power reversing gear which prevented the use of steam to operate in the reversing gear when air pressure failed.

INTERSTATE COMMERCE COMMISSION,
DIVISION OF LOCOMOTIVE BOILER INSPECTION, WASHINGTON,
620 Federal Building, Los Angeles, Cal., Feb. 8, 1917.

Mr. FRANK MCMANAMY,
Chief Inspector, Washington, D.C.

DEAR SIR: I have completed investigation of accident due to derailment of Los Angeles & Salt Lake R.R. locomotive 3703 and herewith submit the following report:

Investigation made at San Bernardino, Cal., and point of accident on February 3rd to 7th, 1917, disclosed that Los Angeles & Salt Lake R.R. locomotive 3703 was derailed while running light on joint track of the Atchison, Topeka & Santa Fe, Coast Lines, between Cajon and Keenbrooke, Cal., at about 9:27 p.m. February 2, 1917.

At the time of the accident, the locomotive was running west-bound uncontrolled at high speed, approximately 80 miles per hour or more, and left the rails of the west-bound track on a 10-degree curve to the left on a descending grade of 2%, rolled over on its right side, destroying a portion of the east-bound track, and came to rest at a point 3.1 miles west of Cajon, Cal.

The crew in charge of the locomotive at the time of derailment was Engineer J. H. Dalzell and Fireman John Davis. Engineer Dalzell has had six years' experience as an engineer on the L. A. & S. L. Railroad and had been employed in this class of service since Nov. 30, 1916. Fireman John Davis had five years' experience as a fireman on this road and had been employed in this class of service about two years. Each had been on duty about 11 hours and 30 minutes, and had about 12 hours' rest previous to this day's work.

When the locomotive derailed, the engineer and fireman were riding on the rear of the tender; Fireman John Davis was instantly killed and Engineer J. H. Dalzell received serious injuries which will incapacitate him for about 60 days.

(A paragraph omitted states the locomotive concerned was equipped with Raggonet power reverse gear.)

Engineer Dalzell and Fireman Davis took charge of this
1930 locomotive on the morning of the day of the accident at San Bernardino; double-headed L. A. & S. L. passenger train
#220 San Bernardino to Victorville, departing San Bernardino at

11:30 a.m. Arrived Victorville at 1:20 p.m.; turned around and departed Victorville at 7:00 p.m. helping freight extra 3639 west as a pusher to Summit. Then cut off, and prepared to run light down the mountain to San Bernardino; departed Summit at 9:05 p.m., following A. T. & S. F. passenger train no. 3rd 21 on the block.

Engineer Dalzell in his testimony states that when he reached a point about 5½ miles west of Summit, when drifting at a speed of 25 or 30 miles per hour, an air pipe broke with a loud report on the right side and the air pressure rapidly went to zero. He applied the brakes with the independent brake valve and reversed the engine, and in this manner reduced the speed to 5 or 6 miles per hour. The air pressure now being all gone, the locomotive did not come to a full stop, so Engineer Dalzell jumped to the ground and tried to block the wheels, but before he could do so the locomotive bounded forward again and he just barely got aboard. It is likely that when all air pressure left the reverse-gear cylinder the link blocks dropped to the bottom of the links, although the reverse lever was still in back motion.

The engineer is of the opinion that the fireman opened the throttle slightly to aid in bringing the locomotive to a stop, but owing to the valve gear having assumed the forward motion, this act increased the speed.

The locomotive rapidly gained headway, as they were then descending a 1.5% grade approaching Cajon, and the engineer set up the tender hand brake, using a wrench as a club to insure of its being fully applied, while the fireman opened the steam valves to the air reverse and went out on the right running board and closed the air valves. In this manner they passed Cajon at 9:24 p.m., only 6 minutes behind A. T. & S. F. passenger train no. 3rd 21, and the locomotive was rapidly gaining a dangerous speed.

They then tried to get the engine in reverse motion by the use of steam in the reverse-gear cylinder; getting no results, Engineer Dalzell states that he personally tried both steam valves and found that they were open, but in feeling the pipe between the fountain valve and intermediate valve he found it cold; he thereupon concluded that there was an obstruction in the pipe, or else it was disconnected and capped, and as the locomotive was then running at a dangerous speed both he and the fireman gave up attempts to stop the locomotive and went back to the rear of the tender and rode there until the derailment occurred.

Engineer Dalzell states that when they passed the automatic block signal, ½ mile east of the point of derailment, it was red, indicating that they were entering the same block as 3rd 21, and if they had not derailed they would soon have been into the rear end of this passenger train.

After the accident, Engineer Dalzell, though suffering with a broken arm and other serious injuries, walked back ½ mile to this block signal and flagged 4th 21, another passenger train which was following closely.

I arrived at the San Bernardino roundhouse for the purpose of making this investigation at 6:30 p.m. Feb. 3, 1917, 21 hours after the accident. At that time the wrecked locomotive had 1931 not yet arrived, but did arrive later at about 8:00 p.m. On account of darkness no thorough inspection was made at that time, but instructions were given to place the locomotive where it would not be molested, and inspection would be made the following morning.

On the following morning (Feb. 4) I questioned Mr. C. M. Hoffman, master mechanic, L. A. & S. L. R.R., Mr. I. C. Hicks, master mechanic, A. T. & S. F. Ry., and Mr. F. M Kemplin, roundhouse foreman, A. T. & S. F. Ry. at San Bernardino, regarding the cause of this accident, and they all replied that they had no information, other than that they had heard that a main reservoir pipe had broken, and they could not account for the failure of the engineer to use the steam in the reversing gear, but presumed it was due to the short time he had in which to get it to work.

Wishing to make tests of the various parts of the brake equipment and that was undamaged, I requested that the air pump be removed and attached to another locomotive of the same class.

And in the meantime, while waiting for this work to be done, in company with the above-named officials I went out to the scene of the derailment, 15 miles from San Bernardino.

On the way, Mr. Hicks mentioned having made a test on another locomotive of the same class on the day following the accident in an effort to determine just how long it would take to get the steam operating in the power reverse gear, and he stated that 25 minutes were consumed before the reverse gear could be operated with steam. I inquired what it was that delayed the operation to such an extent, and he replied that at first they thought there was a blind gasket in the pipe, and they disconnected the unions in an effort to locate it but found none, and finally discovered that the valve at the fountain was closed. As soon as they opened that valve they had no difficulty in operating the reverse gear with steam. But the 25 minutes had been consumed in looking for blind gaskets.

This was the first intimation that I had that it was the practice to use blind gaskets in this pipe, so as soon as I returned to San Bernardino I immediately located the steam line to the air reverse gear on the wrecked locomotice and found the steam valve at the fountain closed tight, so tight that I had to use a wrench to open it. The intermediate valve was found open with the stem broken off flush with the packing nut by the accident.

The union just forward of the intermediate valve was covered with crude oil and dirt, but I easily separated it with my finger. This is the union where the blind gasket would have been applied, but I found none; however, it came apart so easily that I suspected that it had been tampered with, and voiced my suspicions, but Mr. Hicks denied knowledge of any one having molested anything.

The mountain valve to this stem line is right alongside the stem valve to the headlight dynamo.

1931a Engineer Dalzell is very emphatic in his statement that he opened both valves in the steam line to the reverse gear, saying that after he saw that the fountain valve was open he felt of the pipe and found it cold, and as it was night time then the headlight would be burning and the steam pipe to the headlight dynamo consequently be hot, there is no doubt but what he felt of the right pipe. Therefore it looks very much like that some one disconnected the union and removed the blind gasket after the accident occurred.

Inspector W. R. Wright of the Division of Safety, was the first Government representative on the ground, and he states that on the morning of February 3rd, at San Bernardino, Mr. F. N. Kemplin, roundhouse foreman, A. T. & S. F. Ry., stated to him in the presence of a witness that it was common practice to place blind gaskets in the steam pipe to the air reverse gears of locomotives of this class, for the purpose of preventing accidental turning of steam into the reversing gear, to avoid damage to the packing and gaskets in the brake equipment.

Again on February 8 he informed both Inspectors Wright and Kirch that a blind gasket had been removed from the steam pipe to the air reverse gear on L. A. & S. L. locomotive 3704 the next day after the accident to 3703.

At San Bernardino on February 7 in looking through the bulletin book I found a bulletin issued by Master Mechanic Hicks, dated Jan. 12, 1916, advising all enginemen that blind gaskets were being placed in the steam line to the reversing gear. Copy of this bulletin is attached herewith.

Locomotives of the Los Angeles & Salt Lake R.R. operating in helper service out of San Bernardino, (as was the 3703 at the time of the accident) are taken care of at the A. T. & S. F. Ry. roundhouse, and their running repairs are made by employees of the A. T. & S. F. Ry., therefor it can be assumed that if the practice of placing blind gaskets in this steam pipe on A. T. & S. F. locomotives was permissible, it would also be considered permissible on L. A. & S. L. locomotives.

Since the issuance of this bulletin by Mr. Hicks, a new page (page 196–a) has been added to the A. T. & S. F. Ry locomotive folio

1932 which provides for a three-way cock in the steam line to the reversing gear on the A. T. & S. F. locomotives, and provides for the sealing of this three-way cock in the closed position, thus removing the necessity for the use of blind gaskets.

A. T. & S. F. Ry. locomotives are now all equipped with this three-way cock; and L. A. & S. L. locomotives running out of San Bernardino are all being so equipped since the accident.

The right side of locomotive 3703 was so badly damaged by the accident that it is impossible to determine just which air pipe caused the initial failure, but it is presumed that it was the 1½" main reservoir pipe leading from the back end of the right main reservoir to the brake valve, distributing valve, etc. Nearly all of the piping on the right side was destroyed, the reversing gear was destroyed, the distributing valve was not found, the right side of cab was smashed down flat against the boiler, two steel rails entered the right side of smoke arch and pierced the front flue sheet, entering the barrel of boiler for a distance not determined, and one steel rail pierced the right valve chamber head, went on through and pushed the back valve chamber head off. The brake valves, air gauges, air compressor, driver brakes, and driver brake cylinders, were all practically undamaged, and when tested after the accident proved to be in good condition.

The machinery of the locomotive was badly in need of a general overhauling at the time of the accident.

Mr. C. M. Hoffman, master mechanic, L. A. & S. L. R.R., stated that this locomotive was due for the shop, but on account of shortage of power she was being operated until another locomotive of the same class could be turned out of the shop.

Work reports at San Bernardino since January 1, 1917, all indicate that rods and boxes were pounding badly; statements of various engineers all indicate the same thing.

Attached herewith is a list gleaned from the work reports, showing the number of times various defects were reported with no explanation why the work was given no attention, indicating that scant regard is given to rule 104.

There is no doubt that the breaking of the main reservoir pipe was due to vibration caused by excessive pounding of the moving parts of the locomotive.

Examination of the machinery after the accident disclosed that the left #2 #4 driving-box brasses were shimmed; left #4 had been loose but was repaired by the application of a clamp to the driving box. Knuckle joint pins at back end of left front side rod, and at back end of left intermediate side rod had been striking hubs of drivers. Both middle connection brasses were broken—old breaks. Bore of back-end main-rod brasses each exceeded pin diameters 3/32".

In conclusion it is not possible to state that there was a blind gasket in the steam line to the reversing gear, but the evidence all tends to show that the accident could have been avoided were it not for either one of two circumstances:

First: If the engineer is mistaken about opening the steam valve at the fountain, then the accident is due to the inaccessibility of this valve and to its being closed when its normal position should be open.

Second: If the engineer did open this valve, then the accident is due to a blind gasket in the steam line which was removed by someone after the accident.

1933 Attached please find a sketch showing the arrangement of the steam valves to the reverse gear—a blueprint of the right side of this type of locomotive, a profile map showing the track in vicinity of point of accident, photographs of the wrecked locomotive and scene of accident, and testimony of Engineer Dalzell.

Very respectfully,

JASPER C. CRISP, *Inspector.*

1934 *Exhibit 60*

Exhibit no. 60 is a statement covering dates when O–1 engines of the Wabash were placed in service.

Engine	Date placed in service	Engine	Date placed in service
2900	9-6-30.	2909	10-20-30.
2901	9-10-30.	2910	10-29-30.
2902	9-21-30.	2911	10-31-30.
2903	10-1-30.	2912	11-12-30.
2904	10-6-30.	2913	11-13-30.
2905	10-9-30.	2914	11-21-30.
2906	10-10-30.	2915	11-22-30.
2907	10-9-30.	2916	12-18-29 (1930).
2908	10-18-30.	2917	12-19-30.

Exhibit 61

Exhibit no. 61 is record of mileage made by 2900 series or O–1 engines since received from builders to February 28, 1931.

	Engine number	September	October	November	December	January	February
	2900	2,740	5,674	4,566	2,532	2,676	5,803
	2901	2,207	6,060	4,640	4,682	4,208	5,586
	2902	688	5,564	4,776	1,090	2,288	4,958
	2903		4,668	3,907	4,584	4,575	6,093
	2904		3,017	5,607	5,391	5,331	6,534
	2905		3,524	3,668	5,355	6,499	5,297
	2906		3,778	5,397	6,039	5,738	4,873
	2907		3,146	4,138	5,358	5,095	5,862
	2908		1,659	4,543	5,852	7,385	4,248
	2909		1,872	3,726	3,820	5,408	4,536
	2910		312	5,779	3,844	6,803	3,817
	2911		140	3,592	4,105	6,350	6,042
	2912			1,642	4,595	5,746	5,324
	2913			2,712	6,951	5,987	6,674
	2914			1,315	5,121	5,291	6,505
1935	2915			977	4,002	5,478	5,203
	2916				2,083	6,355	3,953
	2917				650	428	

Exhibit 62

Exhibit no. 62 is a summary of work reports on class O engines at Decatur roundhouse, showing defects reported on power reverse gears, during October and November 1930.

Exhibit 62—Continued

OCTOBER

Engine no.	Date	Engineer	Notation made by engineer	Repaired by—
2901	10-24-30	Hemrick	Oil reverse lever. It works hard	Massmore.
2908	10-23-30	Sturgis	Reverse lever works too hard	Augustine.
2907	10-31-30	Mays	Reverse lever binds and works hard in quadrant.	Massmore.

NOVEMBER

2905	11-4-30	Brunner	Reverse lever creeping bad	Augustine.
2905	11-30-30	Sturgis	Air reverse lever creeps	Carroll.
2911	11-12-30	Sturgis	Reverse lever handle so hard can hardly switch cars.	Augustine.

Exhibit 63

Exhibit no. 63 is also a summary of work reports on class O engines, Decatur roundhouse, for the month of December 1930.

Engine no.	Date	Engineer	Notation made by engineer	Repaired by—
2900	12-16	Hemrick	Take up lost motion in reverse gear	Augustine.
2902	12-13	do	Take up lost motion in reverse lever. Oil valves. Reverse lever works too hard.	Do.
2903	12-17	Cloney	Power gear creeping	Do.
2903	12-18	do	Reverse gear creeping bad. Cannot work engine in proper cut-off.	Do.
2905	12-6	Johnson	Roller gone from guide to reach rod back of reverse gear.	Do.
2906	12-14	Chaney	Reversing gear to valves creeps very bad	Do.
2908	12-14	Cloney	Air reverse will not stay put; lets valve travel vary too much.	Do.
1936 2908	12-15	Del. Adams	Reverse gear creeps	Augustine.
2908	12-19	Young	do do floats	Russel.
2908	12-30	Hemrick	Reverse lever creeps bad	Augustine.
2912	12-29-30	Sturges	do do operates too hard and slow	Do.
2913	12-21-30	Nalefski	Reverse gear creeps	Carroll.

Exhibit 64

Exhibit no. 64 consists of summary of work reports for January 1931.

Engine no.	Date	Engineer	Notation made by engineer	Repaired by—
2900	1-15-31	Buck	Air reverse gear floating; tighten piston packing.	Augustine.
2901	1-13-31	Sturges	Tighten reverse lever quadrant	Messmore.
2902	1-16-31	Hemrick	Take up lost motion on reverse gear	Augustine.
2902	1-21-31	Cox	Line up air pipe to power reverse cylinder where connected to main drum pipe there is a bad leak at union.	Kirk.
2903	1-21-31	Nalefski	Reverse gear creeps	Augustine.
2903	1-29-31	Cloney	do do floats bad. Take up lost motion in reverse gear connections. Reverse gear quadrant loose on bracket.	Do. Wright.
2904	1-29-31	Sturges	Oil cup to air reverse cylinder broken off above running board.	Augustine. Lentz.
2905	1-2-31	do	Reverse gear creeps very bad	Doyle.
2905	1-8-31	do	Reverse lever creeps in short cut-off	Messmore.
2905	1-4-31	Mays	Examine reverse gear engine creeps bad	Carroll.
2905	1-10-31	Cloney	Reverse gear creeps bad cannot work engine in proper cut-off.	Fitzgerald.

Exhibit 64—Continued

Engine no.	Date	Engineer	Notation made by engineer	Repaired by—
2905	1-18-31	Cause	Reverse lever creeping bad	Augustine.
2905	1-23-31	Cloney	Reverse lever creeps bad	Do. Fitzgerald.
2906	1-6-31	Erisman	Pack air reversing piston	Augustine.
2907	1-3-31	Hemrick	Reverse lever creeps	Tatham.
2908	1-21-31	Young	...do.... gear...do	Augustine.
1937 2909	1-11-31	Cloney	Reverse lever creeping	Fitzgerald.
2909	1-14-31	.....do	Examine lost motion in reverse gear starting to creep.	Augustine.
2910	1-9-31	Fooshee	Valves creep	Carroll.
2910	1-23-31	Young	Reverse gear works too hard	Messmore.

Exhibit 65. Summary for February 1931

Engine no.	Date	Engineer	Notation made by engineer	Repaired by—
2900	2-1-31	Eirsman	Reverse gear floats bad	Bastob.
2900	2-3-31	Brown	Reverse lever creeps bad	Messmore.
2904	2-17-31	Fooshee	Cap gone off oil cup to air reverse cylinder	Do.
2905	2-9-31	Buck	Tighten air reverse piston packing	Carroll.
2905	2-15-31	Brown	The air pipe the cross-over pipe goes to reversing gear just ahead of main drum right side just about broke off.	C. Augustine.
2907	2-1-31	Gauss	Reverse lever creeping	Messmore.
2907	2-3-31	Nalefski	Reverse gear creeps	Augustine.
2908	2-2-31	Sturgis	Reverse lever creeps in short cut-off	Do.
2908	2-2-31	Cloney	Reverse gear floats bad at times	Do.
2909	2-28-31	Nalefski	Reverse gear creeps and works very hard	Do.
2910	2-13-31	Cloney	Reverse gear kicks off at times; also floats bad.	Bastob.
2915	2-3-31	Eilers	Reverse gear floats	Augustine.

Exhibit 66

Exhibit no. 66 is a statement of power reverse-gear defects reported on F6 locomotives for May and June 1930, at Minneapolis, on the Chicago, Milwaukee, St. Paul & Pacific Railroad.

Engine no.	Name of engineer	Date	Defects reported
6400	Pool	5-21-30	Reverse gear creeps.
6405	Johnson	5-1-30	Reverse lever will not stay put. Drops down at a speed of 50 m.p.h.
6405	Harris	5-9-30	Engine went on one side near Lake City. After slowing up, she squared up.
6405	March	5-15-30	Reverse gear cylinder packing examined as had trouble in creeping forward.
6405	Dickinsen	5-21-30	Valves went lame every 5 or 10 miles and lever creeped Had to reduce speed every time.
1938 6407	Stevenson	5-2-30	Reverse lever jumps. Wearing notches in quadrant.
6411	Conroy	5-6-30	Reverse lever counterbalance spring cover broken and rod going thru spring bent due to reverse lever jumping. Something wrong with valve motion as when Engine gets going over 30 m.p.h. It will go lame and blow out of the stack and reverse lever and apparatus will start jumping, tearing itself all to pieces. Have to shut engine off, reduce speed, and drop lever down very near corner when she will quit jumping and stop blowing until speed again is resumed. (New valve rings R. side.)
6401	Pool	6-6-30	Lug broke on reverse lever.
6401	Tiffany	6-29-30	Valves creep bad, goes clear down and strikes hard. Is very dangerous. (Quadrant cleaned and packing ex.)

Exhibit 66—Continued

Engine no.	Name of engineer	Date	Defects reported
6403	Huber	6-5-30	Valves keep creeping. Have to run engine half stroke to prevent it from creeping.
6403	Keizer	6-24-30	Reverse lever latch will not stay up. Just as soon as train gets going, drops down half stroke.
6403	do	6-26-30	After engine gets going about 30 m.p.h. reverse lever will not stay latched.
6405	Nelson	6-15-30	Reverse gear won't hold after you get going about 40 m.p.h.
6405	Huber	6-11-30	Reverse gear creeps every once in a while.
6405	do	6-9-30	Valve gear creeps bad.
6407	Dorsey	6-27-30	Reverse lever and wheel very loose. Won't stay hooked up where it belongs.
6407	Crouch	6-23-30	Reverse lever doesn't act right. The quadrant seems loose and lever can be shaken when engine is running.
6407	Crouch	6-21-30	Examine air reverse lever. Doesn't seem to act just right.
6412	Tiffany	6-3-30	Air valves in reverse gear reverses and will not stay seated.

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6401	Oeltjender	8-11-31	Reverse gear is creeping.
6403	Pool	7-3	Reverse gear creeping left side—don't lubricate.
6403	Tiffany	7-7	Power reverse gear creeps bad.
6403	Oeltjender	7-12	Reverse gear creeping very bad. Reverse gear and auto brake valve bracket has been vibrating very bad and appears to be very loose on boiler.
[1939] 6403	Cavanaugh	7-18	Air reversing gear creeps bad.
6404	Tiffany	7-25	Air reverse creeps awful bad—repair it.
6404	Celtjender	8-5	Reverse gear is creeping badly.
6404	Tiffany	8-19	Reverse gear creeps bad.
6404	Seyfried	8-24	Take up lost motion in reverse lever. Put a new spring in reverse lever.
6404	Andersen	8-26	Power reverse creeping.
6404	Cavanaugh	8-29	Reverse gear creeps bad.
6405	Dickinsen	7-9	Reverse gear creeps bad.
6405	Cavanaugh	7-16	Seems to be air leak near reversing cylinder.
6405	Stevenson	7-19	Bad leak around air reverse.
6405	Seyfried	8-12	Examine notches to reverse lever—wore bad.
6406	Cavanaugh	7-10	Reverse lever hanger under reversing machine has bolt now instead of pin.
6406	Crouch	7-13	Bolt gone in rocker arm of reverse gear.
6406	Seyfried	7-29	Engine is lame when hooked up. Reverse lever wil not stay latched.
6406	Harris	8-8	Reverse gear creeping.
6407	Seyfried	7-7	Reverse lever jumps out of quadrant.
6407	Dorsey	7-10	Reverse lever creeps in quadrant and works down.
6407	Tiffany	7-15	Cut pin off air reverse lever latch. Reverse lever don't stay latched.
6408	Andersen	7-20-31	Notches broken out of reverse lever quadrant.
6408	Seyfried	7-23	Reverse lever will not stay latched.
6408	Seyfried	8-6	Teeth tore out of quadrant. Cannot hook engine up. Examine reverse gear.
6409	Crouch	7-31	Examine reverse lever for creeping.
6409	Seyfried	8-18	Air does not equalize in reverse lever reservoir.
6410	Celtjender	7-28	Examine reverse gear—creeps.
6410	Seyfried	8-8	Tighten reversing cylinder brackets on boiler.
[1940] 6410	Dorsey	8-21	Reverse lever latch spring gone.
6410	Crouch	8-26	Examine air reverse gear for creeping.
6413	Celtjender	8-17	Reverse gear creeps.

REPORTED AT WESTERN AVENUE FOR MAY AND JUNE 1930

6401	Waite	5-6-30	Air reverse don't work (stop lug broken).
6403	Edwards	5-22-30	Inspect air reverse lever. Keeps jumping out of quadrant. LaX Divn. Engr. said he had trouble all the way with this engine on account of this trouble.
6403	Klumb	5-19-30	Bad reverse lever. Worked down. Cannot keep it hooked up. Teeth worn on quadrant.
6403	Coad	5-11-30	Examine reverse lever, air cylinder and quadrant. Several notches broken and works bad at times.

Exhibit 66—Continued

REPORTED AT WESTERN AVENUE FOR MAY AND JUNE 1930—Continued

Engine no.	Name of engineer	Date	Defects reported
6405	Collins	5-22-30	Reverse lever creeps down when running.
6405	Kaiser	5-2-30	Air reverse creeps. Examine packing.
6406	Sullivan	5-2-30	Counterbalance spring to air reverse loose.
6407	Coad	5-3-30	Examine air reverse gear. Lever will not stay in quadrant. Also lever latch notches are milled out.
6407	Schendel	5-1-30	Reverse lever will not stay in quadrant. Creeping very bad.
6409	Edwards	5-6-30	Examine air reverse piston for air leaks.
6410	Sullivan	5-11-30	Counterbalance spring to air reverse loose.
6401	Foley	6-28-30	Test gasket in reverse cylinder.
6403	Featherstone	6-29-30	Examine reverse gear. Creeping very bad and takes on very bad.
6405	Klumb	6-16-30	Reverse lever works down. Packing leaks in reverse cylinder. Teeth worn out on reverse lever latch and won't hold.
1941 6407	Scott	6-24-30	Air reverse kicks when taken out of center.
6407	Falconer	6-20-30	Air reverse quadrant loose.
6409	Collins	6-3-30	Examine packing in reverse gear cylinder. Engine goes lame at times when lever creeps.
6410	Stephen	6-30-30	Examine reverse gear. Engine creeps very badly.
6410	Collins	6-25-30	Examine cylinder packing in reverse gear cylinder. Lever creeps at times.
6410	Ivens	6-8-30	Power reverse creeps bad.
6402	Griffing	8-3	Valves to reversing gear—valves stick open.
6402	McCormic	8-9	Examine reverse gear and guides—it does not work good.
6403	Price	7-10	Reverse gear creeps. Handles hard.
6404	Putman	8-18	Take up slack forward end rod from reverse lever to valve motion.
6404	Klumb	8-25	Examine packing on air reverse.
6405	Price	7-18	Examine reverse gear—cannot pull lever up.
6406	Schendel	8-16	Reverse gear creeping very bad.
6407	Miller	7-19	Air reverse lever creeps.
6408	Putman	8-2	Air reverse creeps.
6408	Mills	8-15	Power air reverse responds slow and hard.
6409	Miller	7-15	Air reverse works hard and slow.
6410	McCormic	8-1	Examine reverse lever cross head and packing. Don't work just right.
6410	Miller	8-14	Air pipe broke or leaking bad at air reverse cylinder. Examine packing cups in reverse cylinder. Had steam on and the steam is leaking near cylinder.
6411	Price	7- 8	Reverse gear creeps.

Exhibit 67

Exhibit no. 67 covers power reverse gear engine failures on F-6 locomotives of the Chicago, Milwaukee, St. Paul & Pacific R.R. Co., as follows:

Engine number	Date	Division	Train	Time delayed	Kind of reverse gear	Cause
6407	3-8-30	River	17	50 mins.	A	Reverse gear bad order. Housing broken.
6401	3-20-30	La Crosse	56	5 "	A	Reverse cylinder valve arm breaking.
6400	4-7-30	C.&M.	12	8 "	A	Broke valve packing and reverse lever creeping.
6412	6-3-30	River	15	19 "	A	Lug broken off reverse cylinder arm.
6401	6-6-30	do	15	5 "	A	Back stop lug broke off rotary casting of reverse lever.
6406	6-18-30	La Crosse	57	30 "	A	Lug broke off on reverse valve crank.
6406	6-24-30	do	50	10 "	A	Lug broken on air reverse gear.
6413	7-7-30	Trans.-Mo.	16	30 "	A	Reverse lever housing broke.
6409	7-9-30	River	59	17 "	A	Lug broken off reverse cylinder arm.

A. Alco B. Borco S. All Service

Exhibit 67—Continued

Engine number	Date	Division	Train	Time delayed	Kind of reverse gear	Cause
6407	9-24-30	C. & M.	55	10 "	S	Unable to reverse engine.
6408	9-26-30	River	17	9 "	A	Air reverse creeping due to rotary valve leaking.
6407	9-25-30	C. & M.	55	10 "	S	Studs on reverse fulcrum bracket of air reverse cylinder lost out.
6403	12-17-30	River	57	1 hr. 3 "	A	Air pipe to reverse gear broke.
6405	1-25-31	C. & M.	54	20 "	A	Air pipe to power reverse broke off.
6405	1-27-31	C. & M.	54	18 "	A	Plug blew out air reverse lever cylinder.
6406	3-9-31	La Crosse	55	50 "	B	Worm gear section in reverse gear broke.
6406	3-9-31	C. & M.	58	35 "	B	Reverse gear stuck teeth in worm gear broke out.
6413	3-14-31	River	55	11 "	A	Stop lug broke off cylinder arm.
6403	4-21-31	do	57	15 "	A	Lug broke off air reverse cylinder valve. Flaw in casting.
1943 6403	4-19-31	La Crosse	16	15 mins.	A	Lug broke off air reverse.
6406	4-24-31	do	57	30 "	B	Fulcrum arm to Barco air reverse breaking.
9700	5-17-31	H. & D.	15	10 "	A	Reverse gear creeping.
6403	6-9-31	River	55	18 "	A	Reverse gear out of order. Lug broken off.
6408	6-16-31	La Crosse	57	28 "	A	Air pipe to power reverse broke.
6405	7-7-31	Milw	57		A	Air reverse not holding in running position.
6403	7-12-31	River	15	45 "	A	Defective reverse gear—creeping.
6402	7-30-31	Milw	1	22 "	A	Packing blew out of air reverse.
6402	7-31-31	do	1	17 "	A	Nipple to air-pipe connection to reverse-gear control valve broke off.
6402	8-3-31	D. & I.	8	7 "	A	Exhaust valve stuck open on air reverse.
6408	8-6-31	L. & R.	5	25 "	A	Reverse lever going into forward corner.
6410	8-8-31	La Crosse	5	15 "	A	Nipple to air reverse cylinder broke off.
6409	8-14-31	River	56	25 "	A	Air pipe to power reverse-gear control valve broke.
6409	8-15-31	La Crosse	56	25 "	A	Air pipe broke on air reverse cyl.
6409	8-28-31	do	57		A	Nipple to air reverse cylinder broke.
6400	9-15-31	Milw. (1st)	5	Cut-off	A	Reverse gear creeping badly due to engine not lubricating.

A. Alco. B. Borco. S. All Service.

1944 *Statement re exhibit 68*

Exhibit no. 68 shows that on December 21, 1929, Yard Engineer W. E. Reed was operating D., L. & W. engine no. 1612 in Scranton yard (Scranton, Pa.), and while oiling guide cups on left side of engine, reverse lever moved by coworker caught his right arm between radius and guides, fracturing and lacerating thumb, middle and ring fingers, causing a probable disability of two months.

1945 *Exhibit 69*

Exhibit no. 69 is a financial statement of the New York, Chicago & St. Louis Railway, showing certain income for the months of August 1930 and August 1931 and also for the eight months ending August 31, 1930 and 1931.

	Month of August 1931	Month of August 1930	Increase or decrease	8 months ending August 31—		Increase or decrease
				1931	1930	
Total operating revenues	3,129,199.39	3,955,651.73	d 826,452.34	25,482,879.15	32,004,526.16	d 6,521,647.01
Total operating expenses	2,405,907.06	2,868,311.26	d 462,404.20	19,348,845.35	24,241,728.03	d 4,892,882.68
Net operating revenue	723,292.33	1,087,340.47	d 364,048.14	6,134,033.80	7,762,798.13	d 1,628,764.33
Railway tax accruals	210,411.18	222,116.67	d 11,705.49	1,781,411.72	1,645,185.54	136,226.18
Uncollectible railway revenues	14.59	119.58	d 104.99	5,233.12	10,825.26	d 5,592.14
Operating income	512,866.56	865,104.22	d 352,237.66	4,347,388.96	6,106,787.33	d 1,759,398.37
Equipment rents, net	218,704.38	211,224.80	7,479.58	1,861,904.52	1,697,916.90	163,987.62
Joint facility rents, net	34,902.33	50,659.66	d 15,757.33	341,530.54	230,591.61	110,938.93
Net railway operating income	259,259.85	603,219.76	d 343,959.91	2,143,953.60	4,175,278.82	d 2,034,324.92
Dividend income	254,621.83	174,621.83	80,000.00	3,247,942.17	1,408,152.47	1,839,789.70
Other nonoperating income	60,938.30	41,726.13	16,212.17	679,198.99	394,045.91	285,153.08
Gross income	574,819.98	822,567.72	d 247,747.74	6,071,095.06	5,980,477.20	90,617.86
Interest on debt	619,765.50	618,773.61	991.89	5,033,304.30	4,880,276.55	153,027.75
Other deductions	34,273.28	21,462.01	12,811.27	199,654.21	236,382.98	d 36,728.77
Net income	79,218.80	182,332.10	d 261,550.90	838,136.55	863,817.67	d 25,681.12
Balance transferable to profit and loss	79,218.80	182,332.10	d 261,550.90	838,136.55	863,817.67	d 25,681.12
Total operating expense ratio	76.89	72.51	4.38	75.93	75.74	.19

d=deficit.

1946 *Exhibit 70*

Exhibit no. 70 is a summary of miscellaneous statistics of The New York, Chicago and St. Louis Railroad Company.

	Compared with same month 1930	Month of July 1931	7 months ended 7-31-1931	Compared with same period 1930
Freight traffic:				
Total tons of freight carried	d 410,713	1,635,784	11,241,710	d 3,146,935
Total tons of freight carried one mile	d 55,741,000	301,316,000	2,254,017,000	d 555,697,000
Total freight revenue	d $568,418.76	$2,820,675.48	$20,647,173.32	d $5,147,601.65
Total revenue passengers	d 16,109	29,106	171,055	d 92,495
Revenue passengers carried one mile	d 1,500,307	6,526,321	32,208,617	d 9,357,841
Total passenger service train revenue	d $66,734.43	$202,025.78	$1,253,092.19	d $459,297.03
Average passenger service train revenue per mile of road	d $43.85	$132.69	$823.02	d $301.81
Car mileage: Total car mileage	d 3,541,367	26,422,810	195,819,705	d 34,019,240
Train mileage: Total train mileage	d 102,487	659,455	4,743,472	d 1,034,210

d=deficit.

Exhibit 71

Exhibit no. 71 is a summary of income statement for the years 1923 to 1930, inclusive, and for the seven months of 1931 compared with same period of 1930 of The New York, Chicago and St. Louis Railroad Company.

	1923	1924	Percent of inc. or dec. over 1923	1925	Percent of inc. or dec. over 1923	1926	Percent of inc. or dec. over 1923	1927	Percent of inc. or dec. over 1923
Total operating revenues	$57,477,378.99	53,992,434.88	d6.06	54,670,916.66	d4.88	54,938,491.41	d4.42	53,619,600.06	d.671
Total operating expenses	43,938,161.63	40,276,955.85	d8.33	39,604,200.57	d9.86	39,990,395.24	d8.98	38,574,494.34	d12.21
Net operating revenue	13,539,217.36	13,715,479.03	1.30	15,066,716.09	11.28	14,948,096.17	10.41	15,045,105.72	11.12
Operating income	10,679,043.80	10,959,716.50	2.63	12,093,291.18	13.24	11,939,055.41	11.80	12,320,987.75	15.38
Net railway operating income	9,198,854.06	9,589,635.54	4.25	10,592,407.27	15.15	10,157,801.20	10.42	9,995,984.25	8.67
Gross income	10,442,364.26	11,046,515.37		12,120,934.39		13,733,945.16		12,542,801.34	
Net income	6,331,341.61	5,869,246.95	d7.30	6,445,807.25	1.81	8,066,308.23	27.40	6,639,477.12	4.87

	1928	Percent of inc. or dec. over 1923	1929	Percent of inc. or dec. over 1923	1930	Percent of inc. or dec. over 1923	Seven months ended July 31, 1923	Seven months ended July 31, 1930	Percent of inc. or dec. over 1923	Seven months ended July 31, 1931	Percent of inc. or dec. over 1923
Total operating revenues	52,876,519.78	d8.00	56,385,456.53	d1.90	46,533,185.80	d19.04	33,629,941.44	28,048,874.43	d16.60	22,353,679.76	d33.53
Total operating expenses	37,866,536.14	d13.82	39,896,885.25	d9.20	35,111,798.17	d20.09	24,254,888.18	21,373,416.77	d11.88	16,942,938.29	d30.15
Net operating revenue	15,009,983.64	10.86	16,488,571.28	21.78	11,421,387.63	d15.64	9,375,053.26	6,675,457.66	d28.80	5,410,741.47	d42.29
Operating income	12,020,554.77	12.56	13,428,145.87	25.74	8,841,795.16	d17.20	7,530,566.18	5,241,683.11	d30.39	3,834,522.40	d49.08
Net railway operating income	9,556,897.13	3.89	10,471,998.77	13.84	5,648,754.08	d38.59	6,563,125.92	3,575,059.06	d45.53	1,884,694.05	d71.28
Gross income	12,317,502.85		13,687,833.47		12,324,000.66		7,452,884.65	5,157,909.48		5,496,275.08	
Net income	6,378,710.32	.75	7,390,042.33	16.72	4,396,743.73	d30.56	5,190,835.03	681,485.57	d86.87	917,355.35	d82.33

d=decrease.

Exhibit 72

Exhibit no. 72 is as follows:

The New York, Chicago and St. Louis Railroad Company—Statement showing revenue traffic, by years, for the period January 1, 1923 to December 31, 1930 also for the seven months ending July 31, 1931, compared with same period of 1930

	1923	1924	Percent of inc. or dec. over 1923	1925	Percent of inc. or dec. over 1923	1926	Percent of inc. or dec. over 1923	1927	Percent of inc. or dec. over 1923
1. Average miles of road operated, freight service	1,668.68	1,668.68	----------	1,668.68	----------	1,664.93	*.22	1,664.75	*.24
2. Average miles of road operated, passenger service	1,695.30	1,695.30	----------	1,695.30	----------	1,691.55	*.22	1,690.54	*.28
3. Number of revenue tons carried	25,034,211	22,332,761	*10.79	23,138,067	*7.57	23,198,434	*7.33	22,343,038	*10.75
4. Number of revenue tons carried one mile (thousands)	5,260,378	4,879,490	*7.24	5,023,416	*4.50	5,043,026	*4.13	4,832,344	*8.14
5. Freight revenue (account 101)	52,832,311	49,957,936	*5.44	50,801,306	*3.84	51,149,009	*3.19	50,031,353	*5.30
6. Number of revenue passengers carried:									
6-01. Commutation passengers	6,476	7,366	13.74	10,838	67.36	14,052	116.99	9,513	46.90
6-02. All other passengers	905,483	750,521	*17.11	623,655	*31.12	560,643	*38.08	519,720	*42.60
6-03. Total	911,959	757,887	*16.89	634,493	*30.43	574,695	*36.98	529,233	*41.97
7. Number of revenue passengers carried one mile (thousands):									
7-01. Commutation passengers	183	202	10.38	278	51.91	377	106.01	322	75.96
7-02. All other passengers	77,142	66,748	*13.47	63,973	*17.07	64,135	*16.86	61,035	*20.88
7-03. Total	77,325	66,950	*13.42	64,251	*16.91	64,512	*16.57	61,357	*20.65
8. Passenger revenue (account 102):									
8-01. Commutation fares	3,592	3,991	11.11	5,161	43.68	6,897	92.01	5,429	51.14
8-02. All other fares	2,368,884	2,088,703	*11.83	1,942,392	*18.00	1,927,940	*18.61	1,812,213	*23.50
8-03. Total	2,372,476	2,092,694	*11.79	1,947,553	*17.91	1,934,837	*18.45	1,817,642	*23.39
9. Passenger train-miles	2,562,901	2,534,082	*1.12	2,482,696	*3.13	2,418,032	*5.65	2,414,140	*5.80
10. Passenger car-miles	7,478,896	7,225,892	*3.38	7,321,934	*2.10	7,247,970	*3.09	7,071,403	*5.45
AVERAGES									
11. Miles per revenue ton	210.10	218.50	4.00	217.10	3.33	217.40	3.47	216.28	2.94
12. Revenue per ton-mile	1.004	1.024	1.99	1.011	.70	1.014	1.00	1.035	3.09
13. Revenue per ton	2.110	2.337	6.02	2.196	4.08	2.205	4.50	2.239	6.11
14. Miles per passenger	85.20	88.90	4.34	102.60	20.42	114.40	34.27	117.44	37.84
15. Revenue per passenger-mile	3.071	3.129	1.89	3.036	*1.14	3.006	*2.12	2.969	*3.32
16. Revenue per passenger	2.616	2.783	6.38	3.115	19.07	3.439	31.46	3.487	33.30
17. Revenue passengers per train	30.2	26.4	*12.58	25.9	*14.24	26.7	*11.59	25.4	*15.89
18. Revenue passengers per car	10.30	9.30	*9.71	8.80	*14.56	8.90	*13.59	8.68	*15.73

* Indicates deficit.

	1928	Percent of inc. or dec. over 1923	1929	Percent of inc. or dec. over 1923	1930	Percent of inc. or dec. over 1923	Jan. 1 to July 31, 1923	Jan. 1 to July 31, 1930	Percent of inc. or dec. over 1923	Jan. 1 to July 31, 1931	Percent of inc. or dec. over 1923
1. Average miles of road operated, freight service	1,664.75	*0.24	1,664.75	*0.24	1,662.48	*0.37	1,668.68	1,664.10	*0.27	1,660.20	*0.50
2. Average miles of road operated, passenger service	1,690.54	*.28	1,690.54	*.28	1,606.45	*5.24	1,695.30	1,666.51	*1.70	1,522.47	*10.19
3. Number of revenue tons carried	23,610,766	*5.69	25,680,411	2.58	21,290,946	*14.95	15,209,965	12,546,741	*17.51	9,886,619	*35.00
4. Number of revenue tons carried 1 mile (thousands)	4,989,228	*5.15	5,291,371	.59	4,410,397	*16.16	3,113,210	2,659,117	*14.59	2,142,766	*31.17
5. Freight revenue (account 101)	49,346,205	*6.60	52,250,805	*1.10	42,730,002	*19.12	30,953,304	25,794,774	*16.67	20,647,173	*33.30
6. Number of revenue passengers carried:											
6-01. Commutation passengers	6,227	*3.84	9,731	50.26	16,330	152.16	4,166	12,554	201.34	3,864	*7.25
6-02. All other passengers	466,608	*48.47	455,335	*49.71	411,705	*54.53	523,547	250,996	*52.06	167,191	*68.07
6-03. Total	472,835	*48.15	465,066	*49.00	428,035	*53.06	527,713	263,550	*50.6	171,055	*67.59
7. Number of revenue passengers carried 1 mile (thousands):											
7-01. Commutation passengers	226	23.50	349	90.71	379	107.10	116	270	132.76	136	17.24
7-02. All other passengers	63,757	*17.35	69,721	*9.62	70,368	*8.78	41,652	41,297	*.85	32,073	*23.00
7-03. Total	63,983	*17.25	70,070	*9.38	70,747	*8.51	41,768	41,567	.48	32,209	*22.89
8. Passenger revenue (account 102):											
8-01. Commutation fares	4,446	23.78	6,490	80.68	7,077	97.02	2,239	4,833	115.86	2,569	14.74
8-02. All other fares	1,810,688	*23.56	1,976,940	*16.55	1,978,308	*16.49	1,309,191	1,172,000	*10.48	891,392	*31.91
8-03. Total	1,815,134	*23.49	1,983,430	*16.40	1,985,385	*16.32	1,311,430	1,176,833	*10.26	893,961	*31.83
9. Passenger train-miles	2,582,636	.77	2,729,921	6.52	2,665,998	4.02	1,487,330	1,601,347	7.67	1,365,534	*8.19
10. Passenger car-miles	8,251,755	10.33	9,467,249	26.59	9,661,799	29.19	4,191,181	5,864,305	39.92	4,863,951	16.05
AVERAGES											
11. Miles per revenue ton	211.31	.58	206.05	*1.93	207.15	*1.40	204.70	211.94	3.54	216.73	5.88
12. Revenue per ton-mile	.989	*1.49	.987	*1.69	.969	*3.49	.994	.970	*2.41	.964	*3.02
13. Revenue per ton	2.090	*.95	2.035	*3.55	2.007	*4.88	2.035	2.056	1.03	2.088	2.60
14. Miles per passenger	136.64	60.38	153.12	79.72	170.92	100.61	79.60	164.53	106.70	191.83	140.99
15. Revenue per passenger-mile	2.840	*7.52	2.836	*7.65	2.811	*8.47	3.143	2.838	*8.70	2.779	*11.58
16. Revenue per passenger	3.881	48.36	4.342	65.98	4.805	83.68	2.501	4.669	86.69	5.332	113.19
17. Revenue passengers per train	24.8	*17.88	25.7	*14.90	26.5	*12.25	28.1	26.0	*7.47	23.6	*16.01
18. Revenue passengers per car	7.75	*24.76	7.40	*28.16	7.32	*28.93	10.00	7.09	*29.10	6.52	*33.80

* Indicates deficit.

1949 *Exhibit 73*

Exhibit no. 73 is a summary of reverse-gear failures on the New York, New Haven & Hartford Railroad for the years 1928 and 1929.

	Number failures	Total minutes detention	Av. mins. detention per failure	Total miles run	Miles per failure
Hand operated, 1928	2	21	10	11,091,722	5,545,861
Hand operated, 1929	5	125	25	10,984,365	2,196,873
Total for years 1928 and 1929	7	146	21	22,076,087	3,153,727
Power, 1928	13	566	43	8,635,504	664,269
" 1929	15	516	34	8,850,383	590,025
Total for years 1928 and 1929	28	1,082	39	17,485,887	624,496

ENGINE FAILURES AND TRAIN DETENTIONS DUE TO FAILURE OF HAND-OPERATED REVERSE GEARS

Date	Engine number	Train number	Engineer	Point where failure occurred	Time lost	Cause
1-10-28	829	621	Bartley	New Bedford	9 mins	Reverse lever stuck.
10-1-28	1321	115	Detweiler	Willimantic	12 "	Reverse lever caught in forward motion.
1-16-29	833	667	Downing	Campello	20 "	Broken reach rod on reverse lever. Gave up train.
2-19-29	843	7067	Smith	Walpole	5 "	Broken reverse lever.
6-10-29	1346	650	McKensie	E. Foxboro	18 "	Broken dog on rev. lever.
10-10-29	832	616	Brightman	Taunton	35 "	Broken rev. lever latch.
12-3-29	1337	185	Watson	Winslows	47 "	Broken quadrant lever outside of frame. Gave up train.

ENGINE FAILURES AND TRAIN DETENTIONS DUE TO FAILURE OF POWER-OPERATED REVERSE GEARS

1-9-28	1396	31	Kenny	Midway	5 "	Nut came off piston to air reverse cylinder. Gave up train.
1-18-28	3342	BN-3	Joy	E. Greenwich	25 "	Bolt came out of reverse lever.
1949a 2-29-28	3503	BH-3	Chagnon	Providence	1 hr. 50 mins.	Defective check on air-reverse gear.
3-14-28	3506	BN-5	Smith	Midway	1 hr. 6 mins.	Air pipe to air-reverse cylinder broken. Gave up train.
4-4-28	3506	NB-4	Cooper	Auburn	15 mins.	Reverse-lever plug blew out.
5-1-28	1381	47	Watson	Berlin	11 mins.	Broken reverse connection pipe.
5-6-28	1375	88	Thatcher	Hartford	15 mins.	Air reverse failed. Gave up train.
5-11-28	3308	AP-2	Blanchard	Andover	4 hrs. 20 mins.	Reverse lever stuck in forward position. Gave up train.
9-6-28	1361	26	Walton	New London	11 mins.	Air pipe to reverse cylinder broken.
9-15-28	1373	63	Bradley	Springfield	8 "	Broken pin in short reach rod RS.
11-4-28	1365	11	Winslow	New London	7 "	Broken reach rod RS. Gave up train.
11-29-28	1359	1/172	Bernard	Canton Jct.	12 "	Broken air pipe on reverse cyl.
12-25-28	1363	172	Rowe	Providence	21 "	Reverse-gear-piston rod broken in cylinder. Gave up train.
1-1-29	1389	12	Kenny	New London	6 "	Air-reverse creeping. Gave up train.

Exhibit 73—Continued

ENGINE FAILURES AND TRAIN DETENTIONS DUE TO FAILURE OF POWER-OPERATED REVERSE GEARS

Date	Engine number	Train number	Engineer	Point where failure occurred	Time lost	Cause
2-12-29	1360	11	Graves	Midway	27 —	Broken air pipe to reverse cyl. Gave up train.
4-10-29	3338	PH-1	Gates	Sachems Head	15 "	Broken air pipe to reverse cyl
5-18-29	3503	BO-1	Grant	Woodlawn	15 "	Reversing-gear cyl. loose on frame.
6-6-29	3317	NB-4	Jones	Midway	50 "	Nipple from cab end of reverse rod pulled out.
6-18-29	1358	1/2	Mosier	Davisville	7 "	Relief valve stuck on air-rev. gear.
6-25-29	3501	BO-7	Webb	Mansfield	15 "	Pin dropped out bottom of reverse lever.
7-4-29	3501	BO-7	Robinson	Midway	1 hr. 30 mins	Reach rod to reverse disc. Gave up train.
6-18-29	1355	9	Winslow	Slocums	15 mins	Broken air pipe to reverse gear.
1949b 8-5-29	1393	19	Fletcher	Madison	12 mins	Lost bolt out of oil cup on air reverse.
8-11-29	1360	174	Darmody	Back Bay	5 "	Broken reverse-lever pipe.
8-24-29	1360	Extra	Murphy	Midway	30 "	Broken air pipe to reverse gear.
10-27-29	1360	28	Winslow	New London	13 "	Lost pin out of reverse lever.
11-21-29	1357	27	Annable	Newport RD	11 "	Pipe broken at reverse cyl.
11-28-29	3506	NB-4	Webb	Kingston	3 hrs. 25 mins	Reverse gear-casting broken. Studs gone. Gave up train.

Statements re exhibits 74 to 79

Exhibit no. 74 was rejected by the examiner and is not being reproduced here.

1950 Exhibit no. 75 is a statement concerning accidents on the New York, New Haven & Hartford Railroad during August 1931.

New York division: August 20th, Patrick Deady, engineer, at Mamaroneck, N.Y., engine lever kicked back, lacerating foot.

Exhibit no. 76 is a form T monthly report of railway accidents to the Interstate Commerce Commission. It shows that on October 16, 1916, Engineer Carlson was operating engine no. 3503 on passenger train no. 4, Engineer Carlson was oiling engine. Fireman moved engine, catching him between reverse-lever reach and link in their cab. As engineer started to oil around he told fireman to look out for "pot" signal, and when he received same to move engine. Fireman caught signal and called to engineer, who waived his torch. Engineer was standing on ladder oiling high-pressure guides. Fireman thought engineer gave him O.K. signal and moved engine back onto train. When coupling was made, engineer was found injured, crushed through chest, ribs and collar bone broken, also internal injury; probable disability 100 days. No mechanical defects reported.

Exhibit no. 77 is an accident investigation report, file no. 15535-4. On January 8, 1927, Engineer Moore was operating engine no. 3305 in freight service on the Panhandle & Santa Fe near Dugger, Texas. This locomotive was dispatched from Sweetwater, Texas, on an extra, west, in charge of Engineer Moore. About 6:40 a.m., a stop was made at Dugger to take water and set out train, and in spotting at the water tank the locomotive ran past the spout about a foot, and when Engineer Moore tried to reverse the engine to back up to the spout he found that the Ragonnet power reversing gear with which this locomotive was equipped would not reverse. In an effort
1951 to locate the trouble the engineer lit a torch and got down on the ground, instructing the fireman to operate the reverse gear while he watched from the ground. While doing this, Engineer Moore reached in and closed the valve in the air line to the reversing cylinder, and when he opened it again the reversing gear suddenly moved into back motion so that the tumbling arm caught and pinched the engineer's arm, causing the left arm to be lacerated and ligaments bruised, with a probable disability of two weeks. The locomotive was run light to Slaton, Texas, where Engineer Moore was relieved and given medical attention. The reversing gear causing this accident was examined at Slaton, Texas, repairs were made, and no parts were held for Federal inspection. The pertinent part of report is as follows: The valve stem to the reversing gear was bent so that it would not allow the valve to ride on seat, therefore, blowed continually, and in forward corner position the gear would not reverse on account of stem being bent and fouled in the stuffing-box packing nut. The locomotive daily inspection reports for this locomotive were examined at Amarillo and Slaton, Texas, and extracts made as follows:

Amarillo, Texas, Nov. 23, 1926. Time 2:35 p.m. "Tighten packing nut reversing engine piston." Reported by Inspector Dolly. This report approved by Foreman Erich. No notations.

Amarillo, Texas, Nov. 25, 1926. Time 1 a.m. "Renew packing in reversing engine, creeps bad." Reported by Engineer Harris. This report approved by Foreman Urich, without notation.

1951a Slaton, Texas, Dec. 3, 1926. Time 10:30 p.m. "Reverse gear creeps bad." Reported by Engineer Watson. This report was approved by Foreman R. R. Bechtel with notation "Engine doubled."

Slaton, Texas, Dec. 5, 1926. Time 7:30 a.m. "Reversing gear won't reverse good and creeps." This was reported by Engineer Moore following the accident on trip from Sweetwater.

Engineer Moore was interviewed at Slaton, Texas, January 8, 1927, and he stated that judging from the performance of the reversing gear on this trip which resulted in the accident and also the condition the gear was found in at Slaton, Texas, following the accident as reported by the carrier's officials, proper repairs were not made. No

contributory defects were found and the locomotive was not held for Federal inspection.

Exhibit no. 78 is a form T report showing that on Sept. 7, 1928, while northbound A. C. L. passenger no. 82 was running about 50 miles an hour, just south of Dunn, N.C., engineer thought engine had derailed and applied brakes in emergency, resulting in wheels on all cars in train being flattened, necessitating new wheels under cars. Investigation indicates that engine was linked up too
1952 high and the reverse lever creeped up a little, causing engine to "pound", and engineer thought it was derailed. Apparently the engineer was mistaken, but if he thought engine was derailed he was justified in applying brakes. Train was only delayed for a few minutes. No derailment.

Exhibit no. 79 was rejected by the examiner.

Exhibit 80

Exhibit no. 80 is a statistical statement relating to locomotives in service of the Monongahela Railway, January 1, 1931.

EQUIPPED WITH HAND REVERSE GEAR

Number	Number engines	Type	Drivers	Type of gear	Type of valve	Superheated or saturated	Date built
303-304	2	4-4-0	102,300	Stephenson	Slide	Saturated	1905.
305-307	2	4-4-0	103,300	"	Piston	"	1907.
83-99	2	4-6-0	107,000	"	Slide	"	1900-01.
308-310	3	4-4-2	123,000	"	"	"	1903-05.
101-105	5	2-8-0	126,000	"	"	"	1898-99.
100	1	2-8-0	143,650	Walschaert	Piston	Superheated	1921.
115-118, 120-125, 127-128, 130-133, 135, 137	20	2-8-0	170,300	Baker	Slide	Saturated	1909-13.
119, 126	1	2-8-0	170,300	Baker	Piston	Superheated	1909.
129, 134, 136	4	2-8-0	170,300	Walschaert	Slide	Saturated	1910-13.
141-147, 150, 152	9	2-8-0	178,340	Baker	Piston	Superheated	1916-18.
148-149, 151, 153	4	2-8-0	178,340	Walschaert	"	"	1918-23.
Total	53						

EQUIPPED WITH POWER REVERSE GEAR

							Type of gear and date
170-179	10	2-8-2	223,300	Walschaert	Piston	Superheated	Lewis gear, 1919.
180-185	6	2-8-2	236,080	"	"	"	Ragonnet, 1927.
Total	16						
Gr. total	69						

1953 *Exhibit 81*

Exhibit no. 81 is a statement of the Monongahela Railway Company, showing locomotive miles made by locomotives equipped with power reverse gears compared with locomotives equipped with hand reverse gears, January 1, 1919, to December 31, 1931:

Year	Locomotive miles		
	Power equipped	Hand equipped	Total
1919	89,784	851,694	941,478
1920	163,322	675,403	838,725
1921	79,241	722,787	802,028
1922	94,251	695,252	789,503
1923	193,473	1,000,409	1,193,882
1924	116,894	875,180	992,074
1925	153,856	1,041,067	1,194,923
1926	203,499	1,178,584	1,382,083
1927	227,559	1,205,155	1,432,714
1928	253,017	1,108,313	1,361,330
1929	263,180	1,110,994	1,374,174
1930	211,392	899,261	1,110,653
	20,494,468	11,364,099	13,413,367

Exhibit 82

Exhibit no. 82 is a statement reporting defects in power and hand reverse gears on locomotives of the Monongahela Railway Company for the year 1930:

Month	Number of locomotives in service equipped with—		Number of defects reported on locomotives equipped with—		Relative frequency of reported defects	
	Power reverse	Hand reverse	Power reverse	Hand reverse	Power reverse	Hand reverse
January	14	45	16	6	8.6 to	1
February	14	46	14	6	7.7 "	1
March	14	46	11	4	9.0 "	1
April	11	43	12	7	6.7 "	1
May	11	41	13	3	16.1 "	1
June	10	41	17	4	17.4 "	1
July	11	40	9	2	16.9 "	1
August	11	37	6	4	5.0 "	1
September	10	36	7	2	12.6 "	1
October	10	37	14	6	8.6 "	1
November	10	38	7	11	2.4 "	1
December	10	38	10	6	6.3 "	1
Total			136	61	8.1 "	1

1954

Exhibit 83

Exhibit no. 83 is a statement of defects in power and hand reverse gears of locomotives on the Monongahela Railway reported during 1930:

PART I. POWER REVERSE

Engine no.	Date	Defect reported
172	1- 2-30	Air reverse bar creeps.
173	1- 2-30	" " " "
173	1- 3-30	Reverse rotary leaks.
172	1- 4-30	Air reverse bar creeps.
173	1- 8-30	" " " "
172	1- 8-30	" " " "
173	1- 9-30	" " " "
172	1-13-30	" " " "
170	1-14-30	Spring in reverse lever latch.
173	1-16-30	Control valve in reverse gear leaks.
177	1-21-30	Reverse creeps.
173	1-20-30	" "
177	1-24-30	" "
184	1-24-30	Power reverse gear working very hard.
172	1-25-30	Air leak in power reverse.
184	1-30-30	Reverse gear working very stiff.
171	2- 5-30	Reverse gear creeps.
171	2- 6-30	" " "
171	2- 7-30	" " "
171	2-12-30	Reverse rotary valve leaking.
174	2-12-30	Reverse gear creeps.
171	2-15-30	" " "
171	2-19-30	Air leaks in reverse lever control valve.
177	2-19-30	Reverse gear creeps.
184	2-19-30	" " "
171	2-24-30	Air leak in reverse lever control valve.
181	2-25-30	Reverse lever works hard.
184	2-26-30	" " " "
184	2-28-30	Reverse lever works hard.
184	2-28-30	Reverse lever creeps.
184	3- 4-30	Air reverse creeps.
184	3- 5-30	" " "
172	3- 7-30	" " "
172	3-13-30	" " "
171	3-17-30	Automatic control valve of reverse lever leaks.
170	3-19-30	New thumb latch on reverse lever needed.
171	3-27-30	Air reverse creeping.
171	3-27-30	Control valve on reverse lever leaks.
171	3-29-30	Air reverse creeps.
172	3-29-30	" " "
172	4-11-30	Reverse gear creeps.
172	4-12-30	" " "
184	4-16-30	" " works hard.
184	4-17-30	" " creeps.
172	4-18-30	" " "
184	4-20-30	" " works hard.
177	4-23-30	" " creeps.
1955 179	4-24-30	Reverse gear creeps.
176	4-25-30	" " "
180	4-26-30	Reverse lever has slight movement.
171	4-30-30	Reverse gear creeps.
171	5- 6-30	Automatic control valve of power reverse leaks.
185	5- 7-30	Reverse gear creeps.
185	5-11-30	" " "
171	5-12-30	" " "
171	5-13-30	" " "
172	5-14-30	" " "
186	5-17-30	" " "
182	5-24-30	" " "
177	5-24-30	Defective spring in thumb latch of reverse lever.
172	5-25-30	Reverse gear creeps.
182	5-29-30	" " "
171	5-30-30	" " "
182	5-31-30	" " "
171	6- 1-30	Automatic control valve of reverse gear leaking.
182	6- 3-30	Reverse gear creeps.
172	6- 3-30	" " "
171	6- 4-30	" " "
184	6-10-30	Reverse bar handles hard.
185	6-11-30	" " "
171	6-11-30	Reverse gear creeps.
171	6-13-30	" " "
171	6-18-30	Automatic control valve on reverse gear leaking.

Exhibit 83—Continued

PART I. POWER REVERSE—Continued

Engine no.	Date	Defect reported
172	6-19-30	Reverse gear creeps.
177	6-21-30	" " "
176	6-24-30	" " "
173	6-25-30	Air reverse control valve leaking.
174	6-25-30	Reverse gear working hard.
172	6-28-30	Reverse gear creeps.
171	6-28-30	" " "
177	6-29-30	" " "
173	7- 9-30	Air cylinder on reverse gear leaks.
173	7-16-30	Reverse gear creeps.
173	7-17-30	" " "
182	7-18-30	" " "
176	7-24-30	" " "
172	7-27-30	" " "
176	7-27-30	" " "
183	7-28-30	" " "
183	7-31-30	" " "
184	8- 4-30	" " "
172	8-15-30	" " "
183	8-17-30	" " "
183	8-19-30	" " "
183	8-19-30	" " "
171	8-20-30	" " "
171	9- 4-30	" " "
171	9-13-30	" " " and operating hard.
176	9-17-30	Reverse lever latch defective.
171	9-19-30	Reverse gear creeps.
177	9-20-30	" " "
171	9-24-30	Automatic control valve on reverse gear leaking.
170	9-28-30	Reverse gear creeps.
1956 176	10- 1-30	" " "
176	10- 2-30	" " "
170	10- 3-30	" " "
171	10- 6-30	" " "
171	10- 7-30	" " "
172	10- 8-30	" " "
171	10-10-30	" " "
172	10-10-30	" " "
184	10-14-30	" " "
185	10-15-30	" " "
179	10-31-30	" " "
171	10-24-30	Automatic control valve on reverse gear leaking.
172	10-31-30	Reverse lever creeps.
177	10-31-30	Defective spring in reverse lever latch.
172	11- 1-30	Reverse gear creeps.
171	11- 7-30	Reverse gear lever will not stay latched.
171	11- 8-30	Reverse gear creeps.
170	11-14-30	" " "
173	11-22-30	" " "
183	11-26-30	" " "
179	11-28-30	Air reverse jumps when reversing.
182	12- 3-30	Air leaking at exhaust end of reverse-lever reservoir.
183	12- 7-30	Reverse gear creeping.
183	12- 9-30	" " "
185	12- 9-30	" " "
183	12-11-30	" " "
183	12-14-30	" " "
179	12-16-30	" " "
171	12-22-30	" " "
170	12-30-30	" " "
172	12-31-30	" " "

PART II. HAND REVERSE

146	1- 7-30	Engine hard to reverse.
135	1-15-30	Latch not holding in quadrant (spring reverse).
153	1-17-30	Equalizing spring broken. Engine hard to reverse.
148	1-18-30	Engine hard to reverse.
151	1-23-30	Reverse bar handles too hard.
126	1-28-30	Spring in reverse gear needs equalizing.
144	2- 6-30	Valve travel is not equal in front and back motion.
145	2-10-30	Latch lifter rod needs renewal on reverse lever.
120	2-13-30	Reverse lever binding on quadrant.
129	2-17-30	Lost motion in connection between reverse bar and reach rod.
146	2-16-30	Reverse bar bridle broken.
134	2-27-30	Bridle straps on reverse bar too long.
126	3- 5-30	Latch too wide on reverse lever.

Exhibit 83—Continued

PART I. POWER REVERSE—Continued

Engine no.	Date	Defect reported
132	3-22-30	Reverse bar strikes when thrown to reverse end of quadrant.
132	3-22-30	Reverse bar strikes when thrown to reverse end of quadrant.
1957 153	3-25-30	Equalizing spring out of adjustment.
122	4- 3-30	Reverse lever handles hard.
122	4- 4-30	" " " "
129	4- 8-30	" " " "
132	4-12-30	Nuts tightened on quadrant bracket studs, back.
132	4-18-30	Nuts tightened on quadrant bracket studs, back.
132	4-19-30	Nuts tightened on quadrant bracket studs, back.
141	4-20-30	Reverse lever will not stay latched when in forward corner.
122	5- 6-30	Reverse lever works hard.
308	5-15-30	Counterbalance spring needs equalization.
127	5-23-30	Reverse bar latch sticks in quadrant.
308	6- 6-30	Reverse lever catches on jacket bear quadrant.
136	6-19-30	Engine hard to reverse.
152	6-24-30	Reverse bar handles hard.
142	6-24-30	Too much rattle in reverse lever latch lifter.
145	7-24-30	Snag on cotter pin of reverse lever latch.
132	7-26-30	Rear end of quadrant low.
152	8- 9-30	Reverse bar handles hard.
152	8-11-30	" " " "
145	8-29-30	" " " "
132	9- 4-30	Reverse lever will not stay latched.
147	9- 4-30	Not reported—simply says "repair reverse in cab."
150	10-11-30	Reverse bar works hard.
132	10-12-30	Front end of quadrant loose.
132	10-13-30	Engine hard to reverse.
151	10-20-30	" " " "
151	10-21-30	" " " "
143	10-31-30	Reverse lever jumps out of quadrant in forward motion.
139	11- 3-30	Reverse lever handles hard.
153	11- 7-30	Reverse lever handles hard.
141	11-10-30	Reverse lever handles hard.
145	11-10-30	Equalize reverse lever.
142	11-15-30	Engine hard to reverse.
142	11-18-30	" " " "
142	11-21-30	Renew front equalizing spring on reverse gear.
152	11-26-30	Engine reverses hard.
120	11-26-30	Reverse bar slide in cab floor renewed. Slide too short at front end when reverse bar is in back end of quadrant.
153	11-38-30	Engine hard to reverse.
141	11-29-30	Engine hard to reverse.
153	12-16-30	Reverse lever will not go in full gear in either motion.
153	12-22-30	Reverse lever hard to handle.
153	12-24-30	Reverse lever will not go in full gear in either direction.
131	12-24-30	Reverse lever on center, reach rod strikes end of bolt in running-board brace.
309	12-26-30	Reverse lever jumps out of quadrant.
147	12-27-30	Counterbalance spring needs equalizing.

1958 *Statements re exhibits 84 to 92*

Exhibit no. 84 is a form T report showing that on May 3, 1929, Engineer Boggs was operating a switch engine at Decatur, Ill., on the Illinois Central. While oiling around engine, Boggs had his head caught between rod and main reservoir when reverse lever was moved. It was 9:26 p.m. and dark at the time of accident. The engineer was killed.

Exhibit no. 85 is a form T report showing that on May 5, 1928, Yard Fireman Persch was oiling reverse gear on Erie engine 220 in the Readville, Pa., yard. Engine 220 was standing at east end of track #3. Fireman Persch oiling springs underneath boiler.

He asked Engineer P. J. Moffitt to move reverse lever so he could oil the lifting springs of reverse gear, and, while so doing, his fingers were caught between the tumbling shaft and rest. The second and third fingers of hand were badly mangled, resulting in probable disability of 50 days. There were no mechanical defects.

Exhibit no. 86 is a form T report showing that on April 24, 1928, Engineer Brumfield was operating Norfolk & Western engine 2011 at the Portsmouth, Ohio, yard. This was a freight train extra west with 60 loaded cars, 5,461 tons, all air and in service. On arrival in yard the train was pulled in on the hump and stopped, after which engine 2011 was detached from train with instructions to pull up and back through track no. 11 to get the rear of train. In order to back up, it was necessary to reverse engine, which on this engine is done by the use of a Franklin Precision power reverse gear, and when the engineman knocked independent brake off to let it go back off the hump the engine moved and he still had his hand on the reverse wheel, which he claims made a kick-back to a different position from the one he wanted, catching his right hand, breaking same at wrist joint. Immediately after accident a thorough inspection of the reverse gear was made, and it was found in 1959 good condition, there being no defects whatever that would contribute or cause accident, also shortly after engine was placed on the inspection pit. It was moved to various positions and the reverse gear was tried in different positions which developed no defects whatever. Engineman Brumfield has been in service 19 years, with ten hours' rest and on duty eight hours, when injured. The engineer's right arm was broken at wrist, causing 30 days' probable disability.

Exhibit no. 87 is a form T report showing that on April 11, 1928, Fireman Arnold was inspecting N., C. & St. L. engine 625 at Bruceton, Tenn. Fireman was standing with feet on guide, looking for leak around brake cylinder, when engineman reversed engine, causing fireman's body to be caught between radius rod and air drum. Engineman has had 17 years' experience. He had been on duty only a few minutes and had had required rest before reporting for this trip. The fireman received contusion of muscles of abdomen and left side, causing 12 days' actual disability.

Exhibit no. 88 is a form T report which states that on January 20, 1928, Engineer Landers was in charge of N. Y., N. H. & H. switch engine 3614 at Cedar Hill yard, Conn. In thawing out reverse gear, using a torch, the wind blew flame against his hand, burning the back of the right hand, causing 13 days' actual disability.

Exhibit no. 89 is a form T report showing that on May 29, 1929, Engineer Chadwick was in charge of I. C. switch engine no. 1888 at Macomb, Miss. It was 2 a.m. and dark. While reversing engine, engineer was struck in side by the lever. One rib on left side was fractured, resulting in 10 days' probable disability. No mechanical defects reported.

1960 Exhibit no. 90 is a form T report showing that on April 3, 1929, Engineer Gamble was operating S. P. engine 3313 near Robsart, N.Mex. Engine 3313 was pulling extra freight train, east-bound, in charge of Conductor W. J. Russ. It was going about 3 miles per hour when it collided with light engine 4386, west-bound, in charge of Engineer Cooksey, at the west end of approach 1446–A, 1,637 feet west of the west switch at Robsart, at 3:27 a.m. It was dark. The train had 44 cars of sheep and one car of earth, and steel coach immediately ahead of caboose being used as drovers' car and occupied by four attendants.

Engine 3313 damaged on front end and stocker estimated $7,000; first car behind engine, completely demolished, damage $2,000; second car behind engine, knocked off-center, damage $700. Sixty-eight fat lambs killed and eleven crippled and five not accounted for. No one injured on rear of train.

Light engine 4386. This engine was double-heading train no. 1 from Tucumcari. Engineer Cooksey took charge at Cuervo and changed off from second 12. Engine cut out at Elda account left eccentric rod bent. Running light from Elda to Carrizozo, took siding and met 230 at Coyote, secured additional time at Coyote, wait at Robsart until 3:30 a.m. on train no. 232. Air brakes were applied several times between Coyote and one mile east of Robsart by Engineer Cooksey to control speed. One mile east of Robsart, when attempting to apply brakes to reduce speed to enter siding, brakes failed to take effect, and at east switch of siding, Cooksey informed Fireman Mills that had best jump, as he could not stop the engine. They jumped at the east switch; engine moved 5,537 feet to bridge 1446–A, where it collided with train no. 232. Engineer Cooksey states that he could not find steam valve to cut steam into air reverse gear pipe in order to reverse engine. This engine was
1961 moving on a maximum one percent descending grade almost the entire distance between Coyote and Robsart.

Left eccentric rod is broken, thirty-three inches missing from center of rod approximately 75 inches long, with both remaining ends of eccentric rod fastened to their connections, the back one striking cage to lower discharge valve and of the forward air pump and also making marks on reverse gear and main reservoir, proving conclusively that this rod broke prior to collision. Inspection of rod shows that about fifteen percent old flaw at the front break. Engine 4386 is equipped with Alco reverse gear and Baker Pilloid valve gear. No doubt pulsation of the gear contributed to the bending of eccentric rod. The flaw was a hidden defect and could not be detected by ordinary inspection. In fact, flaw is of small area that some unknown strain contributed to the breaking of this rod. Damage to engine 4386, $6,000.00.

Conclusions as reached by the board of inquiry determined that Engineer Cooksey was negligent; first, for his failure to stop immediately after air pump was broken, which he should have known due

to pump racing and air pressure falling on gages and in addition noise which must have been incident to breaking of eccentric rod. Second, for failure to know the location of emergency steam valve immediately ahead of cab of engine on side of boiler, as a protection in case of air failure or reverse gear to work, reversing engine placing it in back motion and stopping with compression in cylinder on the right side. Third, knowing the condition of the engine that it had a bent eccentric rod, he took train order on telephone at 3:15 a.m. with wait at Robsart until 3:30 a.m., a distance of 5.3 miles to pull out of siding Coyote, close switch, and get in siding Robsart within ten minutes with a disabled engine which would be a very quick move with engine in first-class condition.

1962 Engineer Gamble received sprains and bruises resulting in probable disability of 30 days.

Exhibit no. 91 is a form T report stating that on April 9, 1929, Fireman Ryan was firing N.Y.C. engine no. 5214 near Palmyra, N.Y., which was attached to passenger train no. 32. Train was standing. It was 7:20 p.m., and the night was dark and quick unexpected turn of reverse gear wheel twisted the fireman's right hand, causing a fracture of the right wrist and 61 days actual disability.

Exhibit no. 92 is a statement showing the number of locomotives equipped with power reverse gears and the number not so equipped:

"There were received a total of 157 replies to A.R.A. Circular No. D.V. 718, covering 56,968 steam locomotives, of which 27,568 were shown as being equipped with power reverse gears, and 29,400 were shown as being not equipped with power reverse gears. As A.R.A. Circular No. D.V. 718 made no request for information to indicate the approximate cost of applying power reverse gears to the 29,400 steam locomotives shown as not so equipped, a supplementary request was made of the same railroads for this information.

"The replies received to this supplementary request covered a total of 27,807 steam locomotives of the 29,400 previously reported as not being equipped with power reverse gears.

"To equip these 27,807 steam locomotives with power reverse gears, it was estimated would require a total approximate expenditure of $11,447,470.45, or an average, based on the estimates supplied, of $411.68 per locomotive.

"Applying this estimated average cost of $411.68 to the 29,400 steam locomotives reported to us as not being equipped with power reverse gears, develops that it will require a total approximate expenditure of $12,103,392.00 to equip them with power reverse gears."

1963 *Exhibit 93*

Exhibit no. 93 is a statement of the New York, Chicago & St. Louis Railroad Co. showing net income and dividends paid for the years 1923 to 1930, inclusive, and for the 7 months of 1931.

Exhibit 93

	Years ended December 31—								Seven months ended July 31, 1931
	1923	1924	1925	1926	1927	1928	1929	1930	
Net income	$6,331,341.61	$5,869,246.95	$6,445,807.25	$8,066,308.23	$6,639,477.12	$6,378,710.32	$7,390,042.33	$4,396,743.73	$917,355.35
Dividends paid:									
Cumulative pref	1,518,396.00	1,545,381.00	1,547,896.50	1,549,615.50	1,961,430.00	2,112,076.50	2,162,872.50	2,163,087.00	1,081,545.00
Common	1,788,357.00	1,816,393.50	1,819,842.00	3,337,623.75	2,579,409.25	1,971,969.00	2,022,421.50	2,022,541.50	1,012,231.50
Pref. (predecessor company)	249,895.00								
Balance	2,774,693.61	2,507,472.45	3,078,068.75	3,179,068.98	2,098,637.87	2,294,664.82	3,204,748.33	211,115.23	[1]1,176,421.15

[1] Deficit.

Exhibit 94

Exhibit no. 94 is a statement of the Chicago & North Western Railway Co for the year 1930 giving mileage of locomotives equipped with power reverse gear and hand levers.

	Mileage
Power reverse gear: Number locomotives equipped, 779	21, 877, 583
Hand lever: Number locomotives equipped, 1,022	20, 666, 827

1964 *Exhibit 95*

Exhibit no. 95 is a recapitulation of replies received showing estimated cost of applying power reverse gears to steam locomotives not equipped, as of December 31, 1930. Forty-five railroads, from which no replies were received, and 21, which furnished no estimate, are not included herein.

Index no.	Railroad	Total locomotives covered by estimate	Total estimated cost
1	Akron, Canton & Youngstown	7	$2, 800. 00
3	Ann Arbor	36	13, 607. 00
4	Atchison, Topeka & Santa Fe	457	182, 800. 00
7	Atlantic Coast Line	468	178, 402. 00
9	Baltimore & Ohio	1, 713	534, 456. 00
11	Bangor & Aroostook	36	15, 300. 00
12	Bessemer & Lake Erie	45	17, 010. 00
13	Boston & Albany	101	38, 028. 52
14	Boston & Maine	616	215, 600. 00
16	Buffalo Creek	8	2, 400. 00
17	Buffalo, Rochester & Pittsburgh	93	41, 850. 00
20	Canadian National	100	14, 832. 00
21	Canadian Pacific	169	84, 500. 00
22	Central of Georgia	6	996. 86
23	Central R.R. of New Jersey	370	161, 386. 90
24	Central Vermont	17	5, 540. 00
25	Charleston & Western Carolina	41	15, 375. 00
26	Chesapeake & Ohio	124	41, 525. 00
27	Chicago & Alton	220	102, 740. 00
28	Chicago & Eastern Illinois	233	104, 384. 00
30	Chicago & North Western	1, 022	500, 780. 00
31	Chicago & Western Indiana	26	11, 050. 00
33	Chicago, Burlington & Quincy	834	348, 612. 00
34	Chicago, Great Western	143	39, 300. 00
35	Chicago, Indianapolis & Louisville	122	61, 580. 00
36	Chicago, Kalamazoo & Saginaw	3	1, 049. 00
37	Chicago, Milwaukee, St. Paul & Pacific	1, 213	515, 525. 00
39	Chicago, Rock Island & Pacific	878	329, 250. 00
40	Chicago, St. Paul, Minneapolis & Omaha	234	114, 660. 00
41	Cleveland, Cincinnati, Chicago & St. Louis	209	56, 012. 00
42	Clinchfield	11	3, 025. 00
43	Colorado & Southern	88	33, 880. 00
44	Columbus & Greenville	4	1, 515. 92
46	Delaware & Hudson	235	74, 734. 70
47	Delaware, Lackawanna & Western	327	99, 293. 55
48	Denver & Rio Grande Western	356	195, 800. 00
50	Detroit & Mackinac	12	4, 975. 00
51	Detroit, Toledo & Ironton	50	20, 000. 00
53	Duluth, Missabe & Northern	91	36, 400. 00
56	Elgin, Joliet & Eastern	90	34, 200. 00
57	Erie	509	213, 780. 00
59	Florida East Coast	12	4, 160. 04
62	Fort Worth & Denver City	76	37, 012. 00
65	Georgia	34	12, 104. 00
68	Great Northern	693	304, 920. 00
69	Gulf, Mobile & Northern	41	15, 675. 00
70	Huntingdon and Broad Top Mountain	15	5, 250. 00

Exhibit 95—Continued

Index no.	Railroad	Total locomotives covered by estimate	Total estimated cost
71	Illinois Central	231	$115,500.00
72	Indiana Harbor Belt	16	2,500.00
76	Kansas City Southern	98	34,652.80
80	Lake Superior & Ishpeming	1	350.00
81	Lehigh & Hudson River	15	5,250.00
83	Lehigh Valley	271	111,535.47
84	Long Island	18	8,442.00
89	Louisville & Nashville	861	236,775.00
91	Maine Central	123	36,900.00
93	Maryland & Pennsylvania	8	2,400.00
96	Michigan Central	155	59,404.00
99	Minneapolis & St. Louis	168	55,650.00
100	Minneapolis, St. Paul & Sault Ste. Marie	298	133,444.00
102	Missouri & North Arkansas	32	8,960.00
104	Missouri-Kansas-Texas	289	150,125.00
105	Missouri Pacific	376	131,600.00
106	Mobile & Ohio	110	42,020.00
107	Montour	2	1,000.00
108	Nashville, Chattanooga & St. Louis	51	17,850.00
111	New Orleans-Great Northern	20	6,000.00
112	New York Central	793	298,576.00
113	New York, Chicago & St. Louis	182	76,517.27
114	New York, New Haven & Hartford	543	352,950.00
115	New York, Ontario & Western	116	41,180.00
116	Norfolk & Western	370	178,340.00
119	Northern Pacific	735	288,120.00
120	Northwestern Pacific	59	24,675.00
125	Pennsylvania	3,904	1,830,976.00
126	Peoria & Pekin Union	15	4,500.00
128	Pere Marquette	221	88,400.00
129	Pittsburgh & Lake Erie	123	49,972.00
130	Pittsburg & Shawmut	24	11,856.00
132	Pittsburg, Shawmut & Northern	33	11,550.00
134	Quebec Central	1	400.00
137	Reading	626	271,731.24
139	Rutland	61	21,350.00
142	St. Louis-San Francisco	531	196,470.00
143	St. Louis Southwestern	91	38,665.00
144	Savannah & Atlanta	8	2,200.00
145	Seaboard Air Line	304	106,065.60
147	Southern Pacific	1,048	445,400.00
149	Southern	441	176,400.00
150	Spokane International	11	5,885.00
151	Spokane, Portland & Seattle	89	36,931.44
156	Tennessee Central	5	1,627.40
157	Terminal R.R. Association of St. Louis	122	49,308.74
158	Texas & New Orleans	410	146,100.00
159	Texas & Pacific	158	54,596.00
161	Texas, Peoria & Western	3	750.00
166	Union Pacific	704	333,273.00
167	Utah	3	975.00
169	Virginian	19	6,650.00
170	Wabash	380	148,415.00
171	Western Maryland	148	74,150.00
172	Western Pacific	121	38,825.00
174	Wheeling & Lake Erie	74	25,255.00
	Total	27,807	$11,447,470.45
	Average per locomotive	$411.68	

A. I. Ciliske, Chicago, Ill., Oct. 12, 1931.

1965 *Statement re exhibits 96 and 97*

Exhibits nos. 96 and 97 are incorporated in their entirety under separate cover.

Exhibit 98

Exhibit no. 98 is a statement giving revenue, ton-miles, and passenger-miles for the period 1920 to 1930 and seven months ending July 31, 1929, 1930, and 1931, of class I railways in the United States.

Calendar year	Revenue ton-miles	Revenue passenger-miles
1920	410,306,209,802	46,848,667,987
1921	306,840,203,512	37,312,585,966
1922	339,285,347,571	35,469,964,582
1923	412,727,228,422	37,956,594,827
1924	388,415,312,335	36,090,886,478
1925	413,814,261,072	35,950,222,811
1926	443,746,487,348	35,477,524,581
1927	428,736,961,993	33,649,706,115
1928	432,915,184,526	31,601,341,798
1929	447,140,054,000	31,080,753,000
1930	383,805,157,000	26,824,074,000
7 months:		
1929	253,368,232,000	18,011,772,000
1930	223,685,981,000	16,139,833,000
1931	186,016,623,000	13,271,531,000
Percent decline:		
1930 under 1920	6.5	42.7
1930 under 1929	14.2	13.7
7 months:		
1931 under 1930	16.8	17.8
1931 under 1929	26.6	26.3

1966 *Exhibit 99*

Exhibit no. 99 is a form T report showing that on June 25, 1931, Engineman W. P. Harris was operating N. & W. engine 2004 near Portsmouth, Ohio, yard. On the above date freight train extra 2004, west, consisting of 50 loaded cars, all air and in service, arrived in Portsmouth yard when the head 24 cars was cut off and the front part of train pulled up on top of the hump and stopped with engine 2004 at the apex of the hump; in other words, the low-pressure engine was over the apex; that is, the low- and high-pressure engines were [illegible] the hump. While standing in that position Road Frt. Engineman W. P. Harris attempted to reverse engine by using Precision power reverse gear. He was standing in an upright position with both hands on the power reverse gear wheel and handle; that is, his right hand was on the handle and left hand on the wheel and when the gear reached center it kicked back with sufficient force to cause the power reverse gear wheel to spin around rapidly, the result being that his right elbow was knocked against the side of the cab injuring him slightly. The injured party experienced no trouble whatever with the power reverse gear on this engine during the entire trip from Williamson to Portsmouth. An examination developed that there was nothing whatever wrong with the reverse gear. The accident was the result of the position of the engine on the hump, where it stopped straddling the apex of the hump, and when Harris moved the gear from forward to reverse motion when it reached the center, the strain was sufficient to cause

it to kick back as above explained. The injured party has been in the service 33 years with ten hours' rest prior to going on duty and on duty 7 hours and 45 minutes when injured.

1967 Engineer Harris' elbow of right arm was slightly lacerated resulting in 9 days' actual disability.

Exhibit 100

Exhibit no. 100 is a form T report showing that on June 27, 1931, Road Freight Engineer Ensworth was operating Erie no. 3392 at Kent, Ohio. It was 6:30 a.m., and clear. He had just cut engine off train and was reversing it in order to back to roundhouse, when air reverse stuck, causing spring pressure on same to build up, and due to reverse suddenly releasing, handle on reverse wheel struck his right wrist, causing fracture of same. Accident occurred on yard track. Injury caused 6 weeks' disability.

Exhibit 101

Exhibit no. 101 is an accident investigation report of the Bureau of Locomotive Inspection to the Interstate Commerce Commission. It shows that on September 4, 1929, Charles Ross was operating N. Y. C. engine no. 281. At 5:05 p.m., an accident occurred on the N. Y. C. R.R. in East Toledo yards, Toledo, Ohio, in which Engineer Ross had his right arm crushed at the elbow and received internal injuries. Accident was due to locomotive 281 moving forward as Mr. Ross was attempting to remove brake beam from back tender truck.

Locomotive 281 was dispatched from air line junction roundhouse, Toledo, Ohio, on September 4, at 2 p.m., in charge of Engineer Charles Ross and Fireman R. I. Lambright, for service in East Toledo yards. At about 5 p.m. while passing over the Oakdale interlocking plant with one loaded and three empty cars, coupled [illegible] allowed the brake beam to drop. The locomotive, with the cars, was moved over the interlocking plant and in the clear of a road crossing, and on level, straight track.

Fireman Lambright stated, that after the locomotive was stopped he procured coal maul and monkey wrench and got out of cab ahead of Mr. Ross. Before leaving the cab he saw that the

1968 reverse lever was on center and the cylinder cocks were open.

He did not see the position of the brake valve handles but noticed the small air gauge showed 30 pounds brake cylinder pressure. After getting under the tank and finding out what work was necessary he went back into the cab to look at the fire and to see that there was plenty of water in the boiler. There was ¾ glass of water and 160 pounds of steam. He then got under the tender and was helping remove the brake beam. The brake beam seemed free and

the pins were loose in the rods. Mr. Ross was on his back with his head toward the back of the tender. Two pins had been removed when the locomotive started forward. Mr. Lambright got from under the tender as quickly as possible and entered the cab. The reverse lever was in full forward motion and both brake valves were in running position. He made an emergency application with the automatic brake valve, stopping the locomotive after it had moved about 10 feet. He had not heard Mr. Ross complain nor had he noticed any trouble with the brakes or any leakage of throttle through cylinder cocks, but he had heard Mr. Ross say that the throttle was hard to open.

Conductor D. M. Mills stated that the air was not coupled into the 4 cars which were ahead of the locomotive. At time of accident he was returning from the yard office and was about 30 feet from the locomotive when his attention was attracted to locomotive by hearing steam escaping from the cylinder cocks, as it started to move. After the accident he was the first to reach Mr. Ross, who was lying between the rails at the back end of the tender. Mr. Ross told him that he did not know what caused the locomotive to move as he had had the cylinder cocks open, reverse lever on center and the brakes set.

1969 Second trick relay Engineer H. D. Guhl stated, that on September 4th he was delivering locomotive 4297 to relay East Toledo number 1. When he arrived at the Oakdale tower, the yardmaster told him to take engine 281 to air line junction as the brake rigging was torn off and engineer injured. When he arrived at the 281 he was asked by Fireman Lambright and Conductor Mills to examind the reverse lever as it creeped forward. He examined locomotive and found that the number 3 brake beam and rods were missing. Locomotive and tender brakes were operative with the exception of back tender truck where the brake rods were missing. This allowed excessive tender brake piston travel. Tender brake cut out cock was open. He noticed no leakage from the throttle valve.

Examination of locomotive

Locomotive 281, a heavy 8 wheel switcher was equipped with Westinghouse E.T. air brake, chambers throttle with throttle stem connected through the back head, superheater, air operated cylinder cocks, Ragonnet power (air) reverse, Baker valve gear and Nathan 3 feed number 9 lubricator with chokes in the oil pipes at the cylinders. The tender trucks were 4 wheel with cast steel frame. The brake beams were inside center hung.

The right number three brake beam hander, which failed, was a 14-inch forged U, 4 inches wide of one inch round iron, with a 1¼-inch bolt through eyes at top end. Failure was at outside bottom bend, had approximately 50% old defect. The inside bottom corner was also cracked approximately 50% and was an old defect. The

other brake equipment was in good condition and there was no leakage from brake pipes or brake cylinders. The brake pipe pressure was 70 pounds and main reservoir pressure 110 pounds with 55
1970 pounds brake cylinder pressure. The cut out cock to the tender brakes was in open position.

The throttle was in good condition and showed practically no leakage through cylinder cocks.

The teeth on the reverse lever latch and front half of the quadrant were worn badly and the reverse lever could be easily moved from center to full forward motion without lifting latch. The reverse gear cylinder slide valve seat was worn and cut. The leakage through this valve was sufficient to cause the reverse lever, when placed on center to creep into full forward motion.

The holes in the lubricator chokes at the cylinders was 5/64 inch. Mechanical officials of this company, stated that the standard, for openings in these chokes, was $\frac{1}{16}$ inch. Considerable steam came through the cylinder cocks when the steam was turned into the lubricator, although on several tests, with the cylinder cocks closed, this was not sufficient to move the locomotive.

Work reports

Daily inspection reports, form 2 on file at air line junction engine-house were examined covering the period August 20, to time of accident and the following item, which may have had a bearing on this accident, was found reported August 28th at 3:30 p.m. Engineer H. D. Guhl reported "air blows piston rod power reverse." Defect signed for as repaired by "Ganger" and approved by Fireman H. Metzger.

Copy of monthly inspection and repair report form 1 in cab of locomotive was dated August 18, 1929.

Summary

It is evident that if Mr. Ross applied the brakes, he released them before leaving the cab of locomotive, as the tank brake cut out cock was found in open position and Mr. Lambright stated that
1971 the brake beam seemed free and the pins were loose in the rods. Also when he reentered the cab both brake valves were in running position.

While the primary cause of this accident was due to the failure of brake beam hanger, the excessive openings in lubricator chokes allowed the steam pressure to build up against the valves. When reverse gear went into forward motion the steam was submitted into cylinders which caused locomotive to move. Engineer Ross received internal injuries, his left side was partially paralyzed and his right arm crushed, necessitating an amputation above the elbow, resulting in four to six months probable disability.

Exhibit 102

Exhibit no. 102 is an accident investigation report of the Bureau of Locomotive Inspection to the Interstate Commerce Commission. It shows that on August 5, 1931, Engineer Mote was operating E. P. & S. W. engine no. 3308 at Esmond, Ariz.

On August 5, 1931, the main reservoir air pressure was lost on Southern Pacific Company locomotive (E. P. & S. W.) 3308, while operating on a one percent descending grade, causing a loss of control which terminated in a collision of the locomotive with its train, resulting in serious injury to three employees of this carrier.

The accident occurred at 3:44 a.m. on the side track at Esmond, Arizona, on the Tucson division where the main line is single track, over which trains are operated by time table, train order, and automatic block signals. The weather was dark and cloudy with a drizzle of rain falling.

Locomotive 3308 was dispatched at Tucson, Ariz., at 1:00 a.m. on the day of the accident with Engineer Silas W. Mote and Fireman Jas. F. Martin in charge. After the customary terminal air brake tests had been made and no defects noted, the locomotive left Tucson on train no. 410 YV 545, a local freight, east consisting of 34 loads, 21 empties, 2,375 tons, with Conductor R. T. Quint, Head Brakeman P. A. Beal, Swing Brakeman H. T. Strapp, and Rear Brakeman C. C. Boone in charge. Helper locomotive 2709 with Engineer F. Y. Freeman and Fireman T. H. Mims in charge, was coupled in train ahead of the caboose on the rear end.

1972

This train arrived at Esmond, Ariz. (14.7 miles east of Tucson), at 3:05 a.m., and headed in on the sidetrack, south of the main line, where the train with the helper locomotive was left in the clear.

Locomotive 3308 was then cut off, leaving the head end of the train 504 feet in the clear from the east switch of the siding, and proceeded light, accompanied by Brakeman Strapp and Beal, to Vail, Arizona (4.7 miles east of Esmond), to pick up Western Union water car, to be brought to the water column at Esmond, filled with water, and returned with the train to Vail.

At Esmond, the east switch of the siding was left lined for the siding, being protected by Rear Brakeman Boone, who was flagging at the rear end of the train protecting the return of locomotive 3308 to Esmond.

At Vail, the water car was found on the west end of the house track in the Western Union outfit ahead of S.P. car 84756, loaded with Western Union material, so to avoid delay and switching both cars were coupled to the head end of the locomotive and returned to Esmond.

Not anticipating any trouble with the brakes on the locomotive, and it being the opinion of the crew that this was only a switching movement and that the brakes on the locomotive would be sufficient

to hold the cars, the air hose between the locomotive and the two cars were no coupled up.

The maximum grade descending westbound between Vail and Esmond is one percent, minimum 0.57 percent, averaging about
1973 0.9 percent. Commencing 5,840 feet east of the point of the collision the track curves right 0 degrees 20 minutes, a distance of 3,106 feet, and 1,722 feet east of the east siding switch the track curves left 0 degrees 30 minutes to a point beyond the scene of the accident. Including allowance for these curves being compensated the grade is one percent descending westbound.

At Vail, Engineer Mote applied the brakes on the locomotive while backing out of the house track and siding, and slowed up to permit Brakeman Beal to line the switches and get aboard, but Brakeman Beal gave a proceed signal and remained at Vail in charge of the switches. The return trip to Esmond was started with Brakeman Strapp riding the water car. Fireman Martin on the left side of the cab and Engineer Mote sitting on the cab window sill watching the track to the rear of the tender.

About half way between Vail and Esmond the speed of the locomotive slowed up some so Engineer Mote increased the throttle slightly, and just before reaching the mile board east of Esmond he thought he heard the boiler safety valve open and the reverse lever began to jerk. Between the mile board and the distant signal, at which time the speed was estimated to have been about 30 miles per hour, he attempted to set the air and found that he did not have any. He immediately notified Fireman Martin and attempted to reverse the locomotive gear to forward motion and gave it steam, but on account of it being air-operated, the reverse gear failed to respond, consequently the speed of the locomotive was increased. Engineer Mote started blowing the whistle, thinking if someone was near the switch they might understand something was wrong and line the siding switch for the main line. Engineer Mote stated that only a few seconds elapsed after he attempted to reverse the engine
1974 until they entered the siding, and he estimated the speed of the locomotive to have been 30 or 35 miles per hour when it collided with the train.

When Fireman Martin learned that they had lost the air pressure he climbed up on top of the tender and remained there and when the impact occurred he was thrown off and landed on the ground near the tender where he was found a few minutes later by Brakeman Strapp lying unconscious in a pool of water that had run from the tender, with left thigh and left leg broken. Engineer Mote went to the left side of the engine, got down on the steps and dropped off at a point about 332 feet west of the east switch of the siding and sustained injuries when he hit the ground and rolled about 38 feet. Brakeman Strapp first noticed that something was wrong shortly after passing the distant signal when the locomotive started working steam so he stepped over to the south side of the water car and

looked toward the engine to see why the engineer should be working steam, realizing that they had almost reached Esmond. When the locomotive swerved into the east end of the siding he saw a collision was unavoidable and commenced yelling and giving stop signals. Not getting any response he jumped from the water car running board to the ground south of the track about 190 feet west of the east switch of the siding and sprained both ankles when he hit the ground, falling down and rolling over.

The tender collided with C. B. & Q. box car 16060, containing merchandise, the first car in the train, and practically demolished it. The second car in the train, SP–26244, loaded with paper, had east end stove in and sides bulged out and east truck derailed. The under frame of the tender came to rest south of the track partly under wreckage of C. B. & Q. car 16060. The tank of the tender was knocked off the frame and turned up-side-down about 20 feet south of the underframe of the tender. The locomotive cab was telescoped, badly damaged, and forced upward. No. 4 pair of driving wheels were derailed.

1975 Helper locomotive 2709 with caboose left Esmond at 4.07 a.m. with injured parties and arrived at Tucson at 4.40 a.m., being met by ambulances and doctors who took charge of and moved the injured to St. Mary's Hospital. At time of this investigation Engineer Mote and Brakeman Strapp had apparently recovered from their injuries, having been incapacitated for 6 days and 5 days, respectively, while Fireman Martin had been moved to the carrier's general hospital at San Francisco, California. He will quite probably be incapacitated for duty for twelve months or more.

Examination of locomotive 3308 after the collision occurred, by the carrier's officials, disclosed that the loss of the main reservoir air was caused by losing the nut to the union where the 1½-inch discharge pipe leading direct from the air compressors to the main reservoirs coupled onto the elbow at the front air compressor. The loss of this nut permitted the union to separate, allowing the air to escape rapidly from the main reservoirs and connected piping and auxiliaries.

On the morning of the accident Mr. C. M. Loving, locomotive inspector at Tucson, was sent out to locate missing parts of locomotive 3308, and he stated in his report that he found the broken union nut six telegraph poles east of the station one mile board east of Esmond, which is about 6,380 feet east of the east switch of the siding at Esmond.

After the accident locomotive 3308 was moved to Tucson, examined by the carrier's officials, repaired, and returned to service. The broken union nut and the 1½-inch elbow onto which it was screwed were removed and held for Federal inspection.

Evidence on the union nut and the elbow to which it was connected indicated conclusively that the reversing gear left reach

rod jaw where connected to the reverse shaft arm had re-
1976 peatedly fouled and pounded the nut and the elbow until the nut broke through and lost off.

Description of locomotive

Locomotive 3308, a Mikado type designed for freight service, was superheated, and was equipped with a Duplex stoker and with Baker Pilliod valve gear. It had Ragonnet type A power reverse gear operated by air but equipped with an emergency steam line having a steam throttle at the fountain and an intermediate valve at the reverse gear, the latter not being accessible from the cab. Locomotive and tender were equipped with Westinghouse E.T. 6 brake equipment and two 8½-inch Westinghouse cross compound air compressors.

Examination of parts held for Federal inspection

The union nut that broke and lost off the air compressor discharge pipe to the main reservoirs was the carrier's standard equipment. Failure was caused by heavy abrasion which materially weakened the nut, evidently caused by nut being fouled and pounded by the reverse gear left reach rod jaw where connected to the reverse shaft arm, due to inadequate clearance when the gear was in backward motion. Evidence of abrasions on the nut indicate that the condition resulting in failure was accumulative and of long standing.

Federal inspections

The locomotive received class 3 repairs and was turned out of the shops at El Paso, Texas, January 2, 1930, and had made a mileage of 47,723 miles at the time of the accident.

Last annual inspection of this locomotive was made at El Paso, Texas, June 18, 1931, at which time the boiler was given a hydrostatic test and all lagging removed for exterior examination. Quarterly and six-month air-brake equipment cleaning and testing was handled at that time.

1977 Service record of members of crew

All were regular members of the crew, had their legally required rest before being called to go on this trip, and were experienced men having the following service record with the Southern Pacific Co.:

Engineer Silas W. Mote, 34 years (26 years as engineer).
Fireman Jas. F. Martin, 18 years (14 years as engineer).
Conductor R. T. Quint, 26 years (21 years as conductor).
Brakeman H. T. Strapp, 16 years (11 years as conductor).
Brakeman H. B. Beal, 16 years (11 years as conductor).
Brakeman J. C. Boone, 33 years (11 years as conductor).

General condition of locomotive

Not held for Federal inspection (repaired and transferred to another division).

Cause of accident

Valve gear reach rod on left side fouled union nut on 1½-inch discharge pipe leading from air compressor to main air reservoir, causing it to break and lose off, permitting the joint to separate so the air pressure was lost from the main reservoirs. The locomotive was equipped with E. T. brake equipment and air reverse gear; loss of the main reservoir air pressure caused loss of control of the locomotive while it was moving backward on a heavy descending grade which resulted in a collision with its train.

Last monthly inspection was made at Tucson, Arizona, July 20, 1931.

Locomotive daily inspection reports

Report dated at Tucson, Arizona, July 25, 1931, at 12:40 p.m. shows the following reported by Locomotive Inspector C. M. Loving:

1978 "Take lost motion out of reverse gear pins."

This report indicates repairs made by Machinist Hiranda and was approved by Foreman F. L. Powers. Further investigation disclosed that the locomotive was held and the following work done on the valve and reverse gear.

Renewed pins and bushings on reach rod from reverse gear to tumbling shaft.

Renewed pins and bushings on right valve gear adjusting reach rod.

Renewed bushings at bottom of right and left valve gear connecting rods.

Took up lateral in right and left bottom gear connecting rod pins.

Took up lateral in middle connecting rod pins.

This locomotive was making its first trip after the completion of this work when the accident occurred.

Property damage

The carrier's estimate of property damage is as follows:

Damage to locomotive 3308	$300.00
" " tender locomotive 3308	1,200.00
" " car C., B. & Q. 16060 (destroyed)	1,500.00
" " car S.P. 26244	1,000.00
" " way and structure	100.00
" " contents of cars	475.00
Wrecking costs	388.00
Total	4,963.00

1979

Exhibit 103

Exhibit no. 103 is a form T report showing that on August 5, 1931, Engineer Mote was operating S.P. engine 3308 near Esmond, Ariz., about 3:44 a.m. It was dark. The engine was backing up with two cars ahead of the engine, engineer was unable to stop because the main reservoir pipe had broken off, which caused the locomotive and two cars to collide with his own train on a siding. A complete account of the accident is given in exhibit no. 102. Engineer Mote had his back and left side bruised, head bruised, face cut and bruised, resulting in six days disability. Fireman Martin received compound fracture of the left thigh, right leg broken between hip and knee and body bruised resulting in 12 months disability or possibly permanent disability. Brakeman Strapp had both ankles sprained resulting in five days disability. None of the employees rejected Workmen's Compensation Act of Arizona. Train 410 was delayed two hours and 20 minutes.

Exhibit 104

Exhibit no. 104 is a form T report showing that on August 27, 1931, Fireman Stevens was employed on S.P. engine no. 3634 on a freight train near Imlay, Nev. Valve to air reverse was closed and Stevens, in order to open the valve, stood on counter balance. When the valve was opened and before he could get his foot out of the way, air reverse shot forward pinching the foot between counter balance and reverse, breaking three bones in the right foot, causing a probable disability of 30 days.

Exhibit 105

Exhibit no. 105 shows that on February 26, 1923, Engineer Beal was operating P.R.R. engine no. 599 on an extra freight near Logansport, Ind. It was 11:50 a.m. and raining. On the morning of February 26th, J. M. Wyatt, hostler employed at Logansport shop, was instructed to take engine 7660 out of the enginehouse at Logansport and place it on one of the parking tracks to be used in helper service.

1980 Wyatt moved the engine out of the enginehouse onto the turntable, where it was turned and headed west. He then moved it forward off the turntable, intending to stop at the standpipe, about 150 feet west of the turntable. When he attemped to stop at the standpipe, he could not close the throttle. He states he applied the air which would not hold the engine and then he attempted to reverse the lever which he claims he was unable to do because of its working stiff, and was further resisted by the steam pressure due to the fact that the throttle was still open. He then became very much excited and after several ineffectual attempts to

stop the engine became alarmed and deserted it about 1,000 feet west of the turntable.

The engine picked up speed rapidly and moved westwardly through the yard, finally following the route that had been set up for movement of a yard cut from yard C to yard A. At a point 1.75 miles distant from the enginehouse, the engine collided with a yard cut, moving eastwardly on no. 2 track, being handled by regular yard engine 599, doubling heading with helper engine 7440, both engines being headed west.

The tender of engine 7440 was driven forward through the cab of the engine, tearing away the bracket of the foot board near the engineer's seatbox. The foot board bracket being attached to the boiler by stud bolts, one of these bolts pulled through the boiler sheets, allowing the steam under full pressure to escape almost directly under or in front of J. A. Beall, engineman of the 7440, who was pinned by the wreckage in such a manner that he had no opportunity to move from his position and was instantly killed. Conductor H. V. Ulery was slightly injured and R. M. Hoover, fireman, painfully injured, both, also, on engine 7440.

1981 At the time of the collision, it is estimated that engine 7660 was moving at a speed of about thirty miles per hour and the yard cut at a speed of fifteen miles per hour. The closest check of the time consumed in the entire incident was from about 11:43 a.m. at the turntable to about 11:55 a.m. at the time of the collision.

Engine 7660 is an H–6–a engine, simple type, wheel arrangement 2–8–0, total weight on driver 175,700; total weight ready for service, 194,500. The front of the engine was destroyed, main frame broken, and engine trucks broken. Engine 7440 had the tank totally destroyed, cab and cab fittings broken. Engine 599 was only slightly damaged. L.R.N. 5006, empty box car, was destroyed, with only slight damage to other cars. There was slight damage to track.

The engine was turned out of the shop on February 23rd, after receiving heavy repairs. It was used in trial service February 25 in charge of trial engineman C. A. Baker. When he turned the engine in after completion of trial trip on February 25th, he reported the usual small jobs that are found on an engine turned out after receiving heavy repairs. He also reported verbally to one foreman that the throttle lever fulcrum arm should be lengthened three-fourths inches in order to place the handle of the throttle in a convenient position for operation. This work was arranged for by Asst. Erecting Foreman O. Rich. The throttle lever fulcrum was removed, lengthened, and replaced on the engine by the same machinist. After this was done, the engine was inspected and o.k.'d by Foreman Rich and then turned over to Hostler J. M. Wyatt. So far as anyone has been able to determine, there was nothing defective or imperative about the brakes, reverse lever or valve gear on engine 7660 that would have prevented the hostler from controlling the engine after the throttle fulcrum was disconnected.

1982 An examination of the condition of engine 7660 after the collision showed that the throttle lever fulcrum was broken off at the point where the arm joined the hub or base, and it is the opinion of our mechanical people that the fulcrum arm had been welded to the hub or base at the point where it failed, probably in the original manufacture. The failure occurred at the weld which has the appearance of being very faulty and is what is known as "a junk weld."

All possible effort was made by use of telegraph and telephone to derail the engine or divert it in a manner that would avoid accident, but on account of the speed which the engine traveled, this could not be accomplished.

Hostler J. M. Wyatt entered service at Logansport shop as a machinist helper in September 1914, in 1916 he was made a tool inspector; in October 1917 he was made a hostler, which position he has held with the exception of about three months in 1921, when he was reduced to position of laborer on account of reductions in forces. The responsibility for the accident was placed directly on hoster.

The nature and extent of injuries are as follows: Engineer Beal's left leg was severed below knee, body cooked with steam, fatal. Conductor Ulery—top of left shoulder and right ankle bruised, nervous shock, resulting in 60 days' probable disability. Fireman Hoover's right leg below knee bruised, back of head cut, left knee bruised, resulting in 90 days probable disability.

1983 *Exhibit 106*

Exhibit no. 106 is a bulletin of engineers, firemen, and hostlers of the C. & N. W. Ry. at Madison, Wis., dated March 13, 1930.

"Occasionally an engineer is injured by the reverse lever cutting his foot, due to carelessness of the engineman sitting with his foot in front of the reverse lever.

"This bulletin is issued with a view of cautioning all enginemen about injuries that have occurred on this account, and you are cautioned not to place your feet in a position where they can become injured by the reverse lever. Accidents of this kind are preventable and must be eliminated.

"C. V. AXEN, *Master Mechanic.*"

Exhibit 107

Exhibit no. 107 is a bulletin issued at Chicago, March 18, 1931, of all engineers of the C. & N. W. Ry.

"Bulletin no. 4

"*All engineers:*

"We are having some trouble with engines equipped with power reverse gear on account of some engineers hooking these engines up too high and trying to work too short a cut-off.

"When engines are worked at too short a cut-off, the results are as follows: Reverse gear will not hold the valve gear where it belongs, causing it to creep; engine will ride hard if hooked up too high; engine will not lubricate properly; main pins will invariably run hot and a hard strain is put on the valve gear and reverse gear. To overcome some of these conditions, do not attempt to work the engine in less than a six-inch cut-off, then if the speed or the work required of the engine, such as on level track or going down hill, does not require much throttle opening, ease off on the throttle to meet the requirements instead of hooking the lever back until the valve gear is almost at a stand still.

"If you will follow these instructions you will get better performances, better lubrication, a better riding engine, and less trouble from hot pins. Your cooperation on this matter will be appreciated.

"E. HOLMQUIST, *Master Mechanic.*"

1984 *Statement re exhibit 108*

Exhibit no. 108 is not abstract for the reason that it consists of original work reports on which exhibit no. 66 is based.

Exhibit 109

Exhibit no. 109 is a summary of Baltimore & Ohio locomotive inspection work reports turned in by J. E. Geldbaugh from May 2nd, 1930, to May 19th, 1931, inclusive.

Reports turned in at Fairmont, 79; reports turned in at Keyser, 75; making a total of 154 reports.

Power reverse items reported:

F. May 2, '30, Eng. 7212—Piston packing power reverse blowing.
F. " 23, '30, " 7203—Power reverse has had blow at exhaust.
F. " 28, '30, " 7200—Piston packing power reverse leaking.
K. June 3, '30, " 7213—Power reverse creeping bad—no control of valve travel.
K. " 12, '30, " 7133—Renew piston packing on power reverse.
K. " 16, '30, " 7127—Power reverse creeping.
F. " 19, '30, " 7213—Power reverse creeping bad—has blow at exhaust.
K. " 20, '30, " 7213—Overhaul power reverse—had blow at exhaust.
F. " 22, '30, " 7213—Power reverse creeping bad—has blow at exhaust.
K. " 24, '30, " 7213—Overhaul power reverse—has not control of cut-off and bad blow at exhaust.
K. July 3, '30, " 7202—Tighten reverse cylinder bracket.
F. " 8, '30, " 7127—Renew piston packing on power reverse.

Exhibit 109—Continued

Power reverse items reported—Continued

K.	July	9, '30,	Eng.	7127—Power reverse creeping bad
F.	"	13, '30,	"	7135—Renew piston packing on power reverse.
K.	"	14, '30,	"	7135—Piston packing on power reverse blowing —has no control on valve travel.
F.	"	16, '30,	"	7143—Bad blow at exhaust power reverse.
K.	"	19, '30,	"	7202—Power reverse will not reverse when in extreme forward motion.
F.	Aug.	8, '30,	"	7202—Ex P.R. cylinder and valve works hard from back to forward motion.
K.	"	14, '30,	"	7133—Renew piston packing in power reverse.
K.	"	24, '30,	"	7202—Overhaul P.R.—when in forward motion has bad blow at exhaust, when in back motion piston seals itself, working very hard, can not handle engine in switching.
K.	"	28, '30,	"	7214—Power reverse has bad blow at exhaust.
K.	Sept.	14, '30,	"	7214—Power reverse very stiff and slow to operate.
K.	"	16, '30,	"	7107—Power reverse working very stiff.
F.	Oct.	21, '30,	"	7170—Power reverse working hard, slow to operate
F.	Nov.	6, '30,	"	7308—Power reverse has blow at exhaust.
F.	"	18, '30,	"	7301—Power reverse has blow at exhaust.
F.	"	26, '30,	"	7131—Power reverse has bad leak at exhaust.
K.	"	27, '30,	"	7131—Power reverse working bad, has no control over valve travel.
F.	Jan.	1, '31,	"	7115—Piston packing to power reverse leaking.
K.	"	23, "	"	7200—Power reverse working stiff and slow to operate.
1985 K.	Mar.	11, '31,	"	7210—Bad blow at power reverse exhaust.
F.	"	13, '31,	"	7213—Bad blow at exhaust on power reverse.
K.	"	31, '31,	"	7214—Renew joint front head of power reverse cylinder.
F.	Apl.	3, '31,	"	7170—Power reverse creeping very bad.
K.	"	4, '31,	"	7170—Power reverse creeping bad.
F.	"	8, '31,	"	7170—Renew oil cup to power reverse.
K.	"	9, '31,	"	7214—Power reverse has bad blow, front end of reverse cylinder leaking.
K.	"	19, '31,	"	7162—Power reverse works still, don't control cut-off.
K.	May	9, '31,	"	7310—Power reverse working bad, has no control of cut-off.
K.	"	12, '31,	"	7203—Steam line to power reverse bursted back of steam column.

NOTE.—"K" designates work reported at Keyser and "F" designated work reported at Fairmont.

1986 In Supreme Court of the United States

Statement of points to be relied upon and designation of the record to be printed

Filed July 30, 1934

Come now the appellants and say that they will rely on the following points in brief and oral argument before this Court on their appeal in the above-entitled cause:

1. The Interstate Commerce Commission, in hearing and deciding the issues raised in the proceedings before it, proceeded pursuant to authority vested in it by Congress and in discharge of an administrative duty validly imposed upon it.

2. There was substantial evidence to support the findings and order of the Commission.

3. The District Court erred in holding that the Commission failed to give proper consideration to the evidence adduced in the proceeding and in holding that competent evidence was ignored by the Commission, or that there was uncontradicted evidence which the Commission disregarded which, if given effect, would have required a different or contrary conclusion and order than that

1987 made by the Commission.

4. The District Court erred in holding that the Commission did not fairly consider all of the pertinent and substantial facts presented to it.

5. The District Court exceeded its proper authority and judicial function in entering upon a determination, upon conflicting evidence of the fact questions presented in the case before the Commission and thus usurped the administrative functions of the Commission.

6. The action of the Commission was not arbitrary or otherwise in disregard of its duty.

Appellants further state that the entire record in this cause as filed in this Court is necessary for consideration of the points set forth above.

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1988 Service of a copy of the above "Statement of Points to be Relied Upon and Designation of the Record to be Printed", acknowledged this 20th day of July, 1934.

NYE F. MOREHOUSE,
Attorney for Appellees.

[File endorsement omitted.]

(Endorsement on cover:) File No. 38,849. N. Ohio, D.C.U.S. Term No. 221. The United States of America, Interstate Commerce Commission, et al., appellants, vs. The Baltimore and Ohio Railroad Company, Chicago, Burlington & Quincy Railroad Company, The Chicago, Rock Island and Pacific Railway Company, et al. Filed July 26, 1934. File No. 221 O.T. 1934.

U. S. GOVERNMENT PRINTING OFFICE: 1934